AMENDED AGENDA
CALIFORNIA TRAFFIC CONTROL DEVICES COMMITTEE (CTCDC)
December 8, 2004 meeting
Caltrans District 4
111 Grand Avenue (Parkview Room 15-700), Oakland, CA 94623
TIME 9:30 AM

ORGANIZATION ITEMS

1. **Introduction**
2. **Approval of Minutes (August 12, 2004 Meeting)**
3. **Public Comments**

   At this time, members of the public may comment on any item not appearing on the agenda. Matters presented under this item cannot be discussed or acted upon by the Committee at this time. For items appearing on the agenda, the public is invited to make comments at the time the item is considered by the Committee. Any person addressing the Committee will be limited to a maximum of five (5) minutes so that all interested parties have an opportunity to speak. When addressing Committee, please state your name, address, and business or organization you are representing for the record.

AGENDA ITEMS

4. **Public Hearing**

   Prior to adopting rules and regulations prescribing uniform standards and specifications for all official traffic control devices placed pursuant to Section 21400 of the California Vehicle Code (CVC), the Department of Transportation is required to consult with local agencies and hold public hearings.

	04-7	Yellow Change Intervals Timing for the Signals	(Continued) (Bahodri)
	04-8	Railroad Preemption Signals	(Introduction) (Fisher)
	02-16	Signal Warrants I and II	(Continued) (Babico)
Added	04-13	Older Californian Traffic Safety Task Force (Proposal to Amend Sections 2B.45, 2C.50 & 4E.10 of MUTCD 2003)	(Continued) (Meis)
Added	04-14	Proposed CA Supplement text (Target Compliance Dates) (To be added to Introduction part of the CA Supplement, For non-compliant TCDs on existing highways)	(Introduction) (Meis)

5. **Request for Experimentation**

	04-9	Request to Experiment with “Watch The Road” Sign (Experiment Agency – Los Angles DOT)	(Introduction) (Bahadori)

04-10	Slow for the Cone Zone Sign (Experiment Agency – Caltrans)	(Introduction) (Meis)
04-11	Bicycle May Use full Lane (Experiment Agency – City of Santa Cruz)	(Introduction) (Borstel)
04-12	Requests for experimentation with "Flashing Yellow Arrows" (Experiment Agency – City of Fullerton and Pasadena)	(Introduction) (Bahadori)

6. Discussion Items

04-E	Timetable for Combining the MUTCD 2003 and CA Supplement to a single document	(Introduction) (Fisher)
04-F	Section 2C.46 MUTCD 2003 (Distance to place W2-1 or W2-2 Signs)	(Introduction) (Babico)
04-G	Overhead Pedestrian/School Crosswalk Signing with Yellow Flashing Beacons	(Introduction) (Babico)

7 Information Items

01-1	Bicycle Pavement Marking (Shared Lane Marking)	(Continued) (Meis)
04-5	Roundabout signs & Pavement Markings Guidance Proposal	(Continued) (Meis)
Added 04-15	Older Californian Traffic Safety Task Force	(Continued) (Meis)

8. Next Meeting

9. Adjourn

ITEM UNDER EXPERIMENTATION

99-12 Speed Striping FOR Smart Crosswalks **(**Meis)
(Experiment Agency-Caltrans D7)
Status: No update

99-13 Illuminated Pavement Markers on Median Barriers (Meis)
(Experiment Agency-Caltrans D7)
Status: The project has not been funded yet.

01-3 Pedestrian Countdown Signal Heads
(Fisher)
(Citywide Experiment request by the City of Fountain Valley)
Status: The City has submitted their final report to the Committee and has received approval to expand the experimentation as a citywide.

01-4 Tactile Pedestrian Indicator With Audible Information (Tanda)
(Experiment request by the City of Santa Cruz)
Status: No update.

01-7 Pedestrian Countdown Signal Heads (Tanda)
(Experiment Agency-City of Oakland)
Status: The city has received approval from the FHWA and working to acquire funds in the FY 2002-03 budget.

01-9 IN-ROADWAY WARNING LIGHTS AT R/R CROSSINGS (Meis)
(Experiment requests by CPUC in cooperation Kern Co. & City of Fresno)
Status: CPUC is in process to hire consultant firm to conduct a study.

02-2 Pedestrian Countdown Signal Heads (Tanda)
(Experiment Agency-City of Berkeley)
Status: No update.

02-4 Pedestrian Countdown Signal Heads (Larsen)
(Experiment request by the County of San Luis Obispo)
Status: No update

02-15 Radar Guided Dynamic Curve Warning System (Meis)
(Experimentation Agency – Caltrans D5)

03-1 Speed Feedback (Radar Speed) Sign (Fisher)
(Experimentation Agency – City of Whittier)

03-4 Radar Speed Sign (Borstel)
(Experiment Agency – City of Vacaville)

03-5 Radar Speed Sign (Borstel)
(Experiment Agency – City of San Mateo

03-6 Radar Speed Sign (Borstel)
(Experiment Agency – City of San Jose)
Status: City of San Jose planned to conduct the study next fall for the school radar signs that San Jose installed this past fall.

03-13 Variable Speed Limit Sign (Borstel)
(Experiment Request by the City of Campbell)

03-14 Numbering of Signalized Intersections (Babico)
(Experiment Request by the CVAG)

03-15 Radar Speed Sign (Borstel)
(Experiment Request by the City of Freemont)

STATUS OF CALTRANS ACTION ON PAST ITEMS

Item 01-1 U-TURN SIGNAL HEADS INDICATOR

Caltrans will develop appropriate standards to ensure visibility and make the U-turn signal head indicator an official traffic control device by inclusion in the Caltrans Supplement.

Item 00-4 USE OF RAISED PAVEMENT MARKERS IN TRANSVERSE PATTERN

Caltrans will take appropriate action on the recommendation made by the Committee.

Item 02-3 RIGHT EDGELINE

Caltrans will take appropriate action on the recommendation made by the Committee.

04-7 Yellow Change Intervals Timing for the Signals

In the meeting of August 12, 2004, the CTCDC upon discussing the "Yellow Change Intervals Timing for the Signals" matter formed a subcommittee to review this issue, develop recommendations and report back to the CTCDC in the December 2004 meeting. The subcommittee has completed its work, and the following report outlines the subcommittee's discussion and recommendations.

A Report on Yellow Change Interval Timing In California

Prepared by a Subcommittee formed by the

California Traffic Control Devices Committee (CTCDC)

October 2004

Members of the Subcommittee:

Hamid Bahadori
Principal Transportation Engineer / Automobile Club of Southern California

Farhad Mansourian
Director of Public Works / Marin County

Gerry Meis
Manager, Division of Traffic Operations/Caltrans HQ

Ahmad Rastegarpour
Chief, Transportation Management Operational Systems and Software Development Branch / Caltrans HQ

Mark Greenwood
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Yellow Change Interval Clearance Timing
A Report to the California Traffic Control Devices Committee (CTCDC)

A. Background

Municipalities in California have been traditionally using the Caltrans Traffic Manual (recently replaced with the 2003 edition of the MUTCD (Manual on Uniform Traffic Control Devices) as amended with the California Supplement). Signal timing practitioners use table 4D-102 of the California Supplement (which recently replaced Table 9-1 of the Traffic Manual; only in numbering designation and not in content) that recommends minimum timings for the yellow change interval based on the "Approach Speed" of the vehicles. However, the 2003 MUTCD and the California Supplement do not offer a clear definition of "Approach Speed", and it also remains silent on whether these minimum timings should also equally apply to protected left-turn phases. Due to these ambiguities, municipalities in California have different interpretations on both questions.

Although the need for clarification of these issues has been discussed for a long time, the recent increase in the installation of the automated red-light photo enforcement devices, and the change in the state law, has made this a more urgent issue to be addressed by the California Traffic Control Devices Committee (CTCDC) to develop a uniform policy for use in California.

With the passage of the AB 1022, the following section was added to the California Vehicle Code (CVC):

21455.7. (a) At an intersection at which there is an automated enforcement system in operation, the minimum yellow light change interval shall be established in accordance with the Traffic Manual of the Department of Transportation.

However, the different interpretations of the Traffic Manual (now Table 4D-102 of California Supplement) has not only resulted in legal challenges to the tickets issued by the automated devices, with some being successful, it has also created confusion among municipalities using theses devices as to what "legally defensible" yellow change interval timings are.

In order to address these issues the following two questions need to be answered:

1. Should the "approach speed" be more clearly defined, and if so how; i.e., posted speed limit, 85th percentile speed, etc?

2. Should the same "approach speed" be used to establish the minimum yellow change interval for all movements including the left turns? If not, how should the recommended minimums be adjusted for the protected left turn phases?

In their meeting of August 12, 2004, the CTCDC upon discussing this matter formed a subcommittee to review this issue, develop recommendations and report back to the Committee in the next meeting. This report outlines the subcommittee's discussions and recommendations.

B. Discussion

"At the termination of a green phase, motorists approaching a signalized intersection are advised by a yellow signal indication that the red interval is about to commence. The speed and location of some approaching vehicles will be such that they can stop safely at the stop line; others will have to continue at their speed or even accelerate into or through the intersection. The minimum length of the clearance interval (which may include an all-red interval after the yellow indication) should accommodate both situations and eliminate the possibility of a dilemma zone in which a driver can neither stop safely nor legally proceed into or through the intersection." (*Transportation and Traffic Engineering Handbook*; Second Edition; Institute of Transportation Engineers; p. 756) However, the calculation of adequate timing for the yellow change interval has been the subject of many engineering and research studies resulting in various methodologies and formulas.

In facing this challenge, California is not alone. As Philip Tarnoff, a nationally recognized authority on signal timing acknowledges: "Although the calculation and implementation of traffic signal clearance intervals is relatively straightforward, a surprising number of issues are associated with their use." (*Traffic Signal Clearance Intervals*; Tarnoff, Philip; ITE Journal; April 2004). He further explains that part of the challenge might be due to the fact that "there are at least three techniques in use for calculation of yellow time. (There are four if one counts the third term of the kinematic equation as an alternative.)" In his conclusion, Tarnoff acknowledges that "the lack of national uniformity is due to historical usage and the need to accommodate local conditions."

Although a technical discussion of the merits of each of these methodologies is a worthy effort, that debate is beyond the scope of the subcommittee, as the CVC Section 21455.7 has clearly assigned the Caltrans Traffic Manual as the authority for calculation of the yellow change interval timing. Therefore, for the all discussions in this report, Table 4D-102 of the California Supplement (which recently replaced Table 9-1 of Traffic Manual), and the methodology used to calculate its recommended values are considered as the only valid methodology for the State of California.

This assumption will focus the extent of the review and recommendations of this report to only establishing a clear, concise and uniform definition of the "Approach Speed", and the need for any adjustments to the Table 4D-102 minimum yellow timing values for the protected left-turn phases.

Approach Speed

Lack of a clear definition of "Approach Speed" in the 2003 MUTCD and California Supplement might have been intentional by the original authors to offer flexibility to practitioners to accommodate specific intersection needs. However, regardless of the authors' intent, the

outcome of this flexibility is an inconsistency in calculation of the yellow change interval clearance time among different agencies, and even different assumptions for the "Approach Speed" by the same agency at different intersections within their jurisdiction. This is not a desirable situation and has also legal implications for the intersections that use automated red-light photo enforcement.

In developing a concise and uniform definition for the "Approach Speed", traffic safety must be the paramount concern with secondary considerations given to operational issues such as cycle lengths and avoidance of undue lost time for the available green phases. Furthermore, practical implications of this definition such as availability of data, speed measurements and uniformity of application need to be considered as well.

The following alternatives were developed and discussed by the subcommittee as definitions of the "Approach Speed":

1. Use posted speed limit as "Approach Speed"

The most obvious and the simplest to use alternative will be to simply define the "Approach Speed" as the posted speed limit, or the prima facie speed for un-posted arterials. An advantage of using the posted speed is its availability for the filed practitioners. If the arterial has a posted speed limit, a field technician can simply use the posted speed limit in application of Table 4D-102 to determine the yellow change interval. For arterials that do not have a posted speed limit, the CVC assigns the prima facie speed, which is commonly known and can be applied in using the Table 4D-102.

Another advantage of using the posted speed limit as "Approach Speed" is that this is the "legally established" speed for the arterial, and may be more defensible in courts for cases involving the automated red-light violation tickets.

However, this approach may not offer the safest condition for approaching vehicles, and will generally result in a shorter yellow change interval. For example, the City of Costa Mesa found 80% of posted speed limits having higher 85^{th} percentile speeds (132 locations out of 165 total speed surveyed locations). On a cumulative citywide scale, the City found that the posted speed averaged 2.78 MPH less than the 85^{th} percentile.

Posted speed limits are usually a few miles below the measured 85^{th} percentile speeds, as they are rounded downward to the nearest 5-mile increment of the 85^{th} percentile speed, as defined in Section 8 of Traffic Manual. Additionally, in many locations due to local concerns or to accommodate community desires, the posted speed limits are lowered using the provision of "conditions not readily apparent to the drivers" such as proximity to schools, presence of pedestrians or equestrian, etc. Therefore, exclusively applying the posted speed limit for calculation of the yellow clearance time may not achieve the goal of eliminating the dilemma

and may cause trap conditions by forcing motorists in an unsafe manner into intersections, or sudden and unexpected stops resulting in a higher number of rear-end collisions.

Some members of the subcommittee argued that despite these facts, the variance between the "posted" speed and the 85th percentile speed is, in the great majority of cases, within a range of 0 to 4 MPH, and given that intersection approach speeds are typically less than the mid-block 85th percentile speeds, a compromise to safety through applying the "posted" speed limit may not be significant due to such relatively small variations. However, in many cases the posted speed limit could be lower than the 85th percentile by as much as 9 MPH. In those cases using the posted speed limit to determine the minimum yellow change interval will obviously have an adverse effect on traffic safety. These circumstances would also require special engineering judgment beyond the simple determination of yellow timing based solely on the posted speed limit.

They further argued that the posted speed is the speed adopted for the roadway segment as designated by the responsible legislative body, and is established as the law to be obeyed. Assuming proper engineering studies are the basis, the posted speed limit supercedes all supporting data including the 85th percentile speeds. The 85th percentile is only one factor in establishing the legal speed limit. Even though the posted limit is generally based on 15% of drivers exceeding it, it is established as the legal limit. Therefore, they were concerned that using any speed higher than the "posted speed" begs the question if engineers should be expected to use a higher speed, than what has been determined to be "legal", to determine the yellow clearance.

However, others argued that using speeds higher than posted speed limits for operational purposes such as signal coordination projects is a rather common practice in many jurisdictions. Nonetheless, it was equally argued that given the liability implications in applying higher travel speeds to coordinate signals, signal timing engineers in most cases do not exceed the posted speed limit threshold when developing coordination programs.

Another counter argument to this proposal was also made by other subcommittee members suggesting that the primary objective of using 85th percentile speed to reach at a "legally posted speed limit" is a regulatory function, versus using it to "calculate the minimum yellow change interval" which is to enhance traffic safety through providing adequate clearance timing. Therefore, the objectives of these two activities are inherently different, and this argument may not be applicable.

They suggested that the "posted speed limits" are generally established lower than the 85th percentile speed to encourage motorists to drive at lower speeds, and to give a tool to the law enforcement officers to lower traffic speed through punitive measures. However, in using any speed to calculate the minimum yellow change interval, the goal is to maximize the yellow timing to improve traffic safety. Chapter 8 of the Traffic Manual clearly defines that the speed limit should normally be established "at the first five mile per hour increment "below" the 85th

percentile speed." The Manual further states that, "speed limits set at or slightly below the 85th percentile speed provide law enforcement officers with a means of controlling drivers who will not conform to what the majority considers reasonable or prudent." Where posted speed limits demonstrably vary from the 85th percentile, these locations constitute a speed trap and are typically not enforceable nor found credible in court proceedings.

Therefore, it was suggested that using the "posted speed limit" might not achieve the primary goal of yellow change interval timing, which is maximizing motorists' decision time to improve traffic safety.

A fundamental question remained unanswered, due to lack of data, as to whether the application of the "posted speed limit" to establish yellow clearance may adversely affect traffic safety or create dilemma zones for motorists.

Applying the posted speed to determine yellow clearance has been the standard practice among many agencies. The traffic engineering profession recognizes that this application is commonly supplemented, without any specific guidelines for these adjustments, to cover potential anomalies in approach speed.

Based on such applications of the posted speed limit, enforcement agencies acknowledge that motorists have had adequate time to react to the yellow change interval. Legal challenges are rarely encountered where a defendant disputes the adequacy of yellow time based on the appropriately set posted speed limit. In most recent red light running court hearings, where yellow interval settings are debated, the focus has been mostly on discrepancies in yellow timing "methodology" and not the deficiencies in yellow time itself. This discrepancy in yellow timing "methodology" is the impetus for establishing clearer approach speed standards.

Therefore if the historical application of posted speed to determine yellow clearance is typically not found deficient, and given the posted speed limit is the agency established legal speed, then it can be argued that the posted speed limit should be the standard criteria for "Approach Speed".

However, the opponents of this alternative still argued that using the "posted speed limit" to determine the yellow change interval would compromise traffic safety by providing inadequate yellow times.

2. Use the 85th percentile speed as "Approach Speed"

Another alternative to define "Approach Speed" is to use the actual 85th percentile speed as the "Approach Speed". Although this approach may address many of the safety concerns, it has several constraints in its actual application.

First, the 85th percentile speed is a "raw" number and seldom is at exact 5-MPH increment that is needed in the application of Table 4D-102. Therefore, some kind of adjustment to the precise 85th percentile speed must be made to make it useful in determining the minimum yellow change interval value in Table 4D-102. This adjustment should be in "rounding" of the 85th percentile speed to the nearest (up or down) 5-mile increment. To improve traffic safety, it will be desirable to round up the 85th percentile speed to the nearest 5-mile increment, as it will yield a higher value for the minimum yellow change interval.

Second, speed surveys to determine the 85th percentile speed are mostly taken away from the proximity of signalized intersections to benefit from the relatively free flow conditions. An argument may be made that these speeds, as a result, are not truly representative of the speed of vehicles approaching the traffic signal. The correct definition of "Approach Speed" is the speed of vehicles approaching the signalized intersection, which is invariably different that the mid-block travel speed obtained from standard speed studies. Therefore; a true representation of the approach speed based on the 85th percentile would require that separate speed surveys be conducted at the approaches of each intersection, which would then comply with the correct intent and more critically, be "legally defensible". The effort to compile this extent of speed data for each intersection approach would be well beyond the capability of most agencies.

It was also suggested that speed surveys, especially in larger jurisdictions, are normally conducted and maintained by different group of staff than those responsible for signal operations. Therefore, the 85th percentile speed information may not be readily available to signal operations staff. However, such situations are simply not acceptable, and any agency experiencing such situation needs to take corrective steps to remedy it. However, at freeway ramp intersections where Caltrans is responsible for the maintenance and timing for the traffic signals, while the arterial approaches are owned and maintained by local jurisdictions, this may pose some serious inter-jurisdictional and logistical challenges.

It was also argued that the 85% typically change with each radar study, and so creates a moving target. Such ongoing changes in clearance time may cause complications with extended court proceedings and with signal timing and maintenance personnel. As an example, the City of Costa Mesa compared radar speed surveys from 1999 and 2004 and found an overall average vehicle speed change of 2.6 MPH, with 15% of studied locations changing by 5 MPH or greater. This range of variation and associated implications in changing the yellow clearance would have negative consequences relative to operations, maintenance and liability. A more remote possibility, litigation actions may capitalize on this variance by contesting an existing 85% study through conducting new 85% findings and would make it easier to defendants to challenge the validity of the survey. However, changes in prevailing speeds should continuously be monitored by the local traffic engineering staff, and appropriate operational adjustments, such as signal timing, need to be taken to ensure the most efficient and safest traffic flow conditions. Nonetheless, applying the 85th may result in significantly more changes to yellow clearance time on an ongoing basis with associated increased potential in litigation exposure; whereas, use of the posted speed limit may minimize timing variations should continued application of the posted speed be determined safe as is generally acknowledged.

Some members of the subcommittee argued that the agency adopted posted speed limit would provide less variability and volatility. They believed that during the 5 to 7 year transition periods when speed studies are re-assessed as legally required, yellow timings will inevitably change per city, county and state agencies potentially on a wide scale, and discrepancies could lend to legal problems. Additionally should the 85th be applied, any corridor operating under a consistently posted speed limit would likely require different yellow clearance times for each signalized

intersection, given the fact that the 85th percentile is inevitably different for every segment of the corridor. This probable "inconsistency" in yellow clearance times along an extended roadway posted at a common speed limit would create varying expectations for motorists and contribute to legal disputes.

It was further argued that the 85th percentile speed still does not account for the 15% of motorists exceeding this theoretical limit anyway. Safety factors for motorists within this 15% margin would remain unrecognized by adjustments to the clearance time, similar to those travelling over the "posted speed limit", if that speed is used as the "Approach Speed"; therefore, using the 85th percentile speed will not completely resolve the safety concerns associated with the use of "posted speed limit" anyway.

Nonetheless, in using the 85th percentile speed as "Approach Speed", the question of adjustments still remained to be decided. The subcommittee discussed the following two alternatives for such adjustments:

A. Simply round up the 85th percentile speed to the nearest 5-mile increment, and use that value as the "Approach Speed" in using Table 4D-102.
B. Start with the 85th percentile, and allow for engineering judgement, similar to what is used in determining the posted speed limit, in defining the "Approach Speed".

The proponents of Alternative "A" argued that this would maximize traffic safety in reaching a higher value for the minimum yellow change interval in Table 4D-102.

Others argued that Alternative "A" will be too restrictive and will take away flexibility from field practitioners in accounting for specific field conditions.

However, it was suggested that adopting Alternative "B" will probably result in a situation similar to the current practice as it still does not recommend a specific set of guidelines for adjustments to the 85th percentile speed. This will result in different jurisdictions using different criteria resulting in different definitions of "Approach Speed". Furthermore, this approach may still not help the legal dilemma for the intersections that have automated red-light enforcement devices.

In discussing Alternative "A", some members of the subcommittee argued that rounding of the 85th percentile speed should be done to the "nearest 5-MPH increment", while others suggest that it must always be "rounded up" to provide for a longer yellow change interval; therefore, improving traffic safety.

The majority of subcommittee members believed that Alternative "B" will not resolve the current situation and it will still result in using a variety of methods, in the name of "engineering judgement", and will not be an improvement to the existing practice in determining the yellow change interval.

The subcommittee unanimously opposed the idea of developing a more restrictive set of guidelines for those intersections.

3. Use posted speed limit plus 5 miles as "Approach Speed"

This alternative has the benefit of using the readily available posted speed limits while addressing the safety concerns of using the posted speed limit directly for calculation of the yellow clearance timings. This may be a more conservative approach compared to alternatives 1 and 2, and will result in a higher value for the yellow phase. This may improve traffic safety, but may adversely reduce the efficiency of the signalized intersections by allocating more time to the yellow clearance at the expense of shorter green phases. Engineers have recognized that yellow clearance time operationally serves as an extension of the effective green time for the motoring public; therefore, this impact may not be significant. However this approach is in opposition to the premise that the agency adopted posted speed limit is the speed limit recognized by law.

The subcommittee unanimously opposed this alternative.

4. Develop a hybrid alternative for different conditions

In order to maintain flexibility for the field practitioners while having a uniform standard throughout California, it may be desirable to develop a hybrid alternative to accommodate various filed conditions. This alternative incorporates a combination of the three aforementioned options and recommends specific guidelines for their respective uses.

As an example, one alternative could be to apply the higher of either the posted speed limit or the 85^{th} percentile. Another alternative could be to apply the 5-MPH incremental increase to either of the higher values to provide a potential increase in safety. In either case, this could lead to inconsistencies in application, complications with signal engineers and maintenance personnel and potential legal issues.

The subcommittee did not support this alternative.

5. Do Nothing Alternative

It was also suggested that a more specific definition of approach speed might lead to a constrained and controversial policy. Furthermore, the flexibility of the current standard has been adequate prior to introduction of red-light citation disputes, and the judicial system may require further education on the efficacy of the current standard. Accordingly a "do nothing" alternative was proposed, assuming that nothing may be "broken" requiring a "fix". Therefore, different methods may be used by different agencies as is currently the case, including:

1. Posted limit – An agency legally set limit typically based on a speed study.
2. 85th Percentile (rounded) - Based on an engineering field survey.
3. 85th Percentile rounded up – (slightly more conservative than the engineering survey).
4. Posted plus 5 mph – (More conservative and comparable to the 85th)

Under this scenario, each agency would be responsible to defend its own policies and practices for timing of the yellow change intervals at the traffic signals within its jurisdiction.

The subcommittee members with legal expertise found this alternative unacceptable given their experience in attempting to defend State yellow clearance/approach speed standards that lack clarity and consistency in application.

Adjustments for protected left-turn phases

The 2003 MUTCD and California Supplement do not make any recommendations regarding the reduction of the minimum yellow clearance timings shown in Table 4D-102. However, it is a common practice among practitioners to use a smaller value for the protected left turn phases compared to the through movements for the same approach. This practice is mostly for allowing more time for the green time. It is also argued that the left turning vehicles have a lower "Approach Speed" compared to those who travel straight through the intersection. Although this argument may be true for many cases, it may not be the case for relatively long left turn pockets and/or the left turn pockets having long transitions in excess of 120' on wide arterials, especially for 2-lane left turn pockets.

While the vehicles may actually lower their speed when making their left turns through the intersection, that lowered speed is lower than the speed at which the vehicles are approaching the intersection when they are within the dilemma zone. Since the primary reason for the yellow clearance is the elimination of the "dilemma zone", using the lower
turning speed of vehicles while making the turn may not be an appropriate approach to calculate the minimum yellow change interval for left turning vehicles.

Many agencies in California use a 25 MPH "Approach Speed" for the left run phases resulting in a minimum 3-second yellow change interval for left turn phases. Although this value may be appropriate in most cases, it is not adequate for all cases. Furthermore, this downward adjustment is neither recommended nor supported in any shape or form by the 2003 MUTCD and California Supplement.

Limited data and field observations by some jurisdictions such as City of Garden Grove have resulted in that jurisdiction's increase of the minimum yellow timing to 3.2 seconds, which corresponds to a 30 MPH "Approach Speed" in Table 4D-102. However, under that approach, still all left turn phases are treated equally regardless of the intersection geometry, number of left turn pockets, length of transition, and other field conditions. Increasing the minimum yellow timing for all left turn pockets from 3 seconds to 3.2 seconds definitely improves traffic safety,

but it still may not address many field conditions, as discussed previously in this section, where the "Approach Speed" of left turning vehicles may be closer to 35 MPH requiring a minimum 3.6 seconds yellow clearance timing.

Furthermore, since neither 2003 MUTCD nor the California Supplement make any reference for allowing a lower "Approach Speed" for the protected left turn phases, any lowering of the minimum yellow times as recommended in Table 4D-102, may face a serious legal challenge at locations with automated red-light photo enforcement. This further confirms the need and urgency for development of a uniform policy by the CTCDC.

Although establishing an across the board minimum yellow timing for all protected left turn phases may be the easiest and least controversial solution to this situation, it will not necessarily be in the best interest of traffic safety.

The subcommittee in addressing this matter considered variations of tiered approaches. The following two concepts, just as examples, were discussed:

Concept 1:

- For protected left phases where there is only a single left turn pocket that is no longer than 250 feet with a transition not exceeding 120 feet, the minimum yellow clearance interval shall be 3.2 seconds.
- For protected left turn phases where there is a double or triple left turn pocket, or where there is a single pocket longer than 250 feet, and for all cases where the transition exceeds 120 feet, the minimum yellow clearance interval shall be 3.6 seconds.
- For all conditions where the posted or prima facie speed limit on the approach leg is 25 MPH, using a 3-second minimum yellow time for protected left turn phases is allowed.

Concept 2:

- 3.2 second minimum yellow, with consideration of geometric and operational intersection approach factors.
- 3.6 second minimum yellow where adjacent through lane speeds are greater than 40 MPH, with consideration of geometric and operational intersection approach factors.
- 25 MPH or Prima Facie speed limits – Minimum 3-second yellow, with consideration of geometric and operational intersection approach factors.

Although the subcommittee unanimously agreed on the rationale behind any possible adjustments to the minimum yellow change interval values in Table 4D-012 when applied to the protected left-turn phases, the subcommittee believed that establishing any guidelines for such adjustments in absence of extensive field observations and research can not be supported.

Therefore, the subcommittee did not recommend any changes to the 2003 MUTCD/California Supplement, and absent any such changes, any reduction in the yellow time for protected left turns, compared to through movements, is till an unjustified adjustment subject to legal challenges, especially in red-light photo enforcement cases.

However, the Subcommittee is aware of the fact that the majority of agencies set lower yellow clearance times for protected left-turn movements than for through movements, and they may soon face legal challenges for citations issues by the automated red-light enforcement devices. Such legal challenges may force the urgency of this issue.

C. Legal Issues

Regulations that relate to the "uniform standards and specifications for official traffic control devices pursuant to Section 21400 of the Vehicle Code" are specifically exempted from the Administrative Law provisions of California Government Code section 11340 et. seq. This means that those items specifically exempted do not need to be approved through the Office of Administrative Law established by the State Legislature. Furthermore, the Department of Transportation is authorized to "adopt rules and regulations prescribing uniform standards and specifications for all official traffic control devices. . ." (*See* California Vehicle Code section 21400.)

Therefore, the Legislature has given the Department of Transportation express authority to promulgate rules and regulations regarding uniform standards and specifications for traffic control devices, which rules and regulations constitute the Traffic Manual.

California Vehicle Code (CVC) section 21455.7 reads as follows:

> *21455.7. (a) At an intersection at which there is an automated enforcement system in operation, the minimum yellow light change interval shall be established in accordance with the Traffic Manual of the Department of Transportation.*

In general when a provision of a State statute references another statute or incorporates another "living" document, such as the Traffic Manual, that is subject to change through either through legislative act or administrative process, it implidely recognizes that the statue statute or document incorporated may change from time to time and automatically includes any subsequent changes to the statute or document referred to. This is usually accomplished by including the phrase "or as may be amended from time to time" (i.e., as established in accordance with the Traffic Manual of the Department of Transportation, as may be amended from time to time."). However, in this case this phrase is not included in the text of the statute. Nonetheless, it is understood that the statute would still incorporate any subsequent changes made to the referenced document such as the recent replacement of the Traffic Manual with the 2003 MUTC and California Supplement and does not require further legislative action.

The recommendations of this report, when adopted by the CTCDC, will also be in compliance with the essence and intent of the CVC section 21455.7, and will not require any further legislative action.

However, to further reinforce and clarify this matter, additional language may be suggested in the next legislative cycle in a transportation omnibus bill without the need for introduction of any direct or specific bills.

D. Recommendations

The subcommittee unanimously agreed that the existing situation and lack of a specific definition for "Approach Speed" in Table 4D-102 is not acceptable.

However, the subcommittee could not reach unanimous consent on a single definition for "Approach Speed", and decided to forward this report with the following three alternative recommendations to the California Traffic Control Devices Committee (CTCDC) for a final decision:

A. For all applications of Table 4D-102 for determination of the minimum yellow change interval, "Approach Speed" is the posted speed limit, or the prima facie speed limit established by the California Vehicle Code (CVC) in absence of a posted speed limit.
B. For all applications of Table 4D-102 for determination of the minimum yellow change interval, "Approach Speed" is the most recent 85^{th} percentile speed rounded to the nearest 5-MPH increment, for each intersection approach.
C. For all applications of Table 4D-102 for determination of the minimum yellow change interval, "Approach Speed" is the most recent 85^{th} percentile speed rounded up to the nearest 5 MPH increment, for each intersection approach.

Alternatives B and C are only different in recommending rounding of the 85^{th} percentile speed to either "nearest 5 MPH increment" or "rounding up to the nearest 5 MPH increment", respectively.

04-8 Railroad Preemption Signals P 1 of 3

The following are revised Sections 8B.06 and 10C.09 and revised Figures 8B-3, 10C-2 as discussed with the California Public Utilities representatives on August 11, 2004.

Section 8B.06 Turn Restrictions During Preemption

Guidance:

At a signalized intersection that is located within 60 m (200 ft) of a highway-rail grade crossing, measured from the edge of the track to the edge of the roadway, where the intersection traffic control signals are preempted by the approach of a train, all existing turning movements toward the highway-rail grade crossing should be prohibited during the signal preemption sequences.

Option:

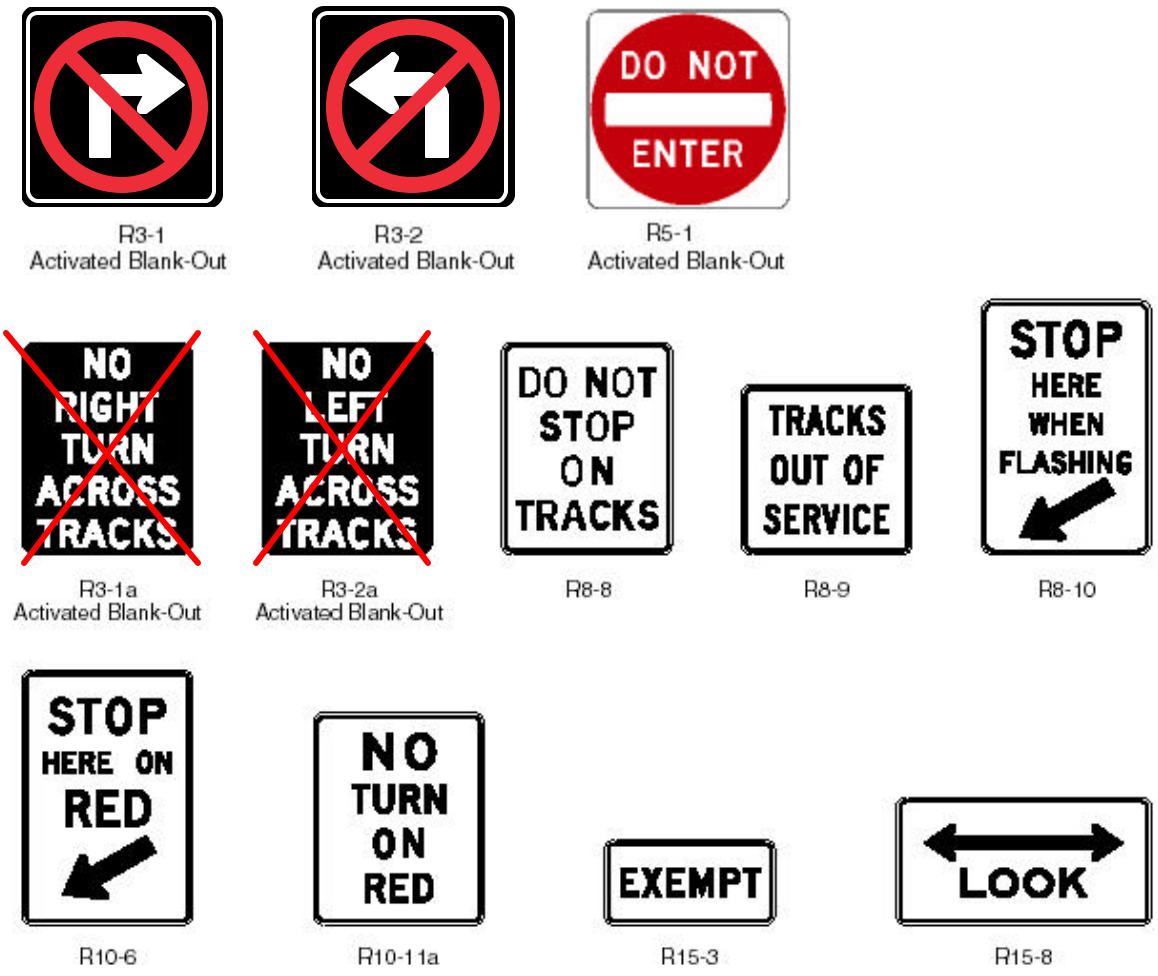
A blank-out or changeable message sign and/or appropriate highway traffic signal indication or other similar type sign may be used to prohibit turning movements toward the highway-rail grade crossing during preemption. ~~The R3-1a and R3-2a signs shown in Figure 8B-3 may be used for this purpose~~ *The R3-1, R3-2 and R5-1 signs shown in Figures 2B-3 and 2B-9 may be used for this purpose.*

Standard:

Turn prohibition signs that are associated with preemption shall be visible only when the highway-rail grade crossing restriction is in effect.

Delete the R3-1a and R3-2a signs from the following Figure 8B-3:

Revised *Figure 8B-3. Regulatory Signs*



R3-1 Activated Blank-Out
R3-2 Activated Blank-Out
R5-1 Activated Blank-Out
R3-1a Activated Blank-Out
R3-2a Activated Blank-Out
R8-8
R8-9
R8-10
R10-6
R10-11a
R15-3
R15-8

Section 10C.09 Light Rail Transit-Activated Blank-Out Turn Prohibition Signs (~~R3-1a, R3-2a~~ *R3-1, R3-2 and R5-1*)

Support:
Light rail transit operations can include the use of activated blank-out sign technology for turn prohibition (~~R3-1a, R3-2a~~ *R3-1, R3-2 and R5-1*) signs (see Figure 10C-2). The signs are typically used on roads paralleling a semiexclusive or mixed-use light rail transit alignment where road users might turn across the light rail transit tracks. A blank-out sign displays its message only when activated. When not activated, the sign face is blank.

Guidance:
A light rail transit-activated blank-out turn prohibition sign should be used where an intersection adjacent to a highway-light rail transit crossing is controlled by STOP signs, or is controlled by traffic control signals with permissive turn movements for road users crossing the tracks.

Option:
A light rail transit-activated blank-out turn prohibition sign may be used for turning movements that cross the tracks.

As an alternative to light rail transit-activated blank-out turn prohibition signs at intersections with traffic control signals, exclusive traffic control signal phases such that all movements that cross the tracks have a red indication may be used in combination with NO TURN ON RED (R10-11a) signs.

Standard:
Turn prohibition signs that are associated with preemption shall be visible only when the highwaylight rail transit grade crossing restriction is in effect.

Revised

Figure 10C-2. Regulatory Signs

R3-1
Activated Blank-Out

R3-2
Activated Blank-Out

R5-1
Activated Blank-Out

R3-1a
Activated Blank-Out

R3-2a
Activated Blank-Out

R8-8

R8-9

R8-10

R10-6

R10-11a

R15-3

R15-4a

R15-4b

R15-4c

R15-5

R15-5a

R15-6

R15-6a

R15-7

R15-7a

R15-8

2-16 Signal Warrants I & II

During the August 2004 CTCDC meeting it was suggested to revise MUTCD 2003 Section 4C.01 to make clear to users. The strike out text will be replaced with red color text and this Section will be included in the California Supplement.

MUTCD 2003, Section 4C.01

Option:
At an intersection with a high volume of left-turn traffic from the major street, the signal warrant analysis may be performed in a manner ~~that considers the higher of the major street left-turn volumes as the "minor street" volume and the corresponding single direction of opposing traffic on the major street as the "major street" volume~~ *that considers the higher of the major-street left-turn volumes plus the higher-volume minor-street approach as the "minor street" volume and both approaches of the major street minus the higher of the major-street left-turn volume as the "major street" volume*.

For signal warrants analysis, bicyclists may be counted as either vehicles or pedestrians.

O4-13 Older Californian Traffic Safety Task Force

During the August 12, 2004 CTCDC meeting, Older Californian Traffic Safety Task Force stated that they would bring a few items for the Committee's consideration to adopt in California. The following Sections are recommended to be included into the California Supplement.

Recommendation #1

Section 2B.45 Traffic Signal Signs (R10-1 through R10-21)

Existing CA Supplement Section 2B.45 text on page 2B-39 (Delete and replace with Proposed text):

Option:

A supplemental sign, to the NO TURN ON RED (R10-11a) sign, may be used on the near right or left at intersections that are extremely wide or skewed.

Proposed CA Supplement text (Proposed in lieu of the above existing text):

Guidance:

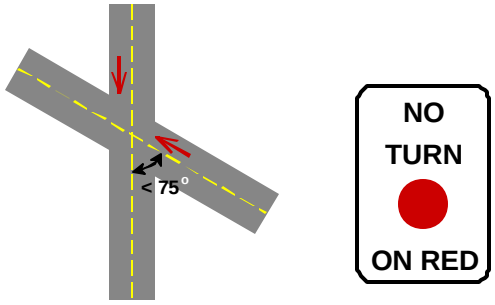
A symbolic NO TURN ON RED (R10-11) sign (see Figure 2B-19) should be used on the near right or left of skewed intersections where the adjacent approach leg to the left intersects the driver's approach leg at an angle of less than 75 degrees.

Option:

A symbolic NO TURN ON RED (R10-11) sign (see Figure 2B-19) may be used on the near right or left of extremely wide intersections

Background:

At skewed intersections where the approach leg to the left intersects the driver's approach leg at an angle of less than 75 degrees, the prohibition of right turn on red (RTOR) is recommended



Rationale

At signalized intersections, the problems associated with skewed intersections are compounded by higher traffic volumes, fewer gaps (in some cases), and more information to process (e.g., the signal phase).

Diminished Capability

Same as described for A1 and A2.

Supporting Evidence

In the 1997 FHWA study previously noted, it was found that the fewer drivers made RTOR maneuvers at skewed intersections where it was more difficult to view oncoming traffic. (Staplin, Harkey, Lococo, and Tarawneh, 1997).

More evidence related to the RTOR issue is provided for Design Element I – Traffic Control for Right-Turn/RTOR Movements at Signalized Intersections.

Relationship to Other Guides

Section 2B.45 of the MUTCD does note that RTOR prohibitions should be considered when one or more of five conditions are met, including:

- inadequate sight distance to approaching vehicles, and
- geometric or operational inadequacies that might result in unexpected conflicts.

Recommendation #14

Section 2C.50 CROSS TRAFFIC DOES NOT STOP Plaque (W4-4p)

Existing MUTCD 2003 Section 2C.50 text (Keep existing MUTCD text and add proposed text):

Option:

The CROSS TRAFFIC DOES NOT STOP (W4-4p) plaque (see Figure 2C-8) may be used in combination with a STOP sign when engineering judgment indicates that conditions are present that are causing or could cause drivers to misinterpret the intersection as an all-way stop.

Proposed CA Supplement text to Section 2C.50 (Add proposed text in addition to the above text):

Option:

The CROSS TRAFFIC DOES NOT STOP (W4-4p) plaque (see Figure 2C-8) may be used in combination with a STOP sign at two-way stop-controlled intersections when a conversion from four-way stop to two-way stop operations is implemented.

Background:

The use of a 750-mm x 450-mm (30-in x 18-in) supplemental warning sign panel (W4-4p), as illustrated, mounted below the STOP (R1-1) sign, is recommended for two-way stop-controlled intersection sites selected on the basis of crash experience; where the sight triangle is restricted; and wherever a conversion from four-way stop to two-way stop operations is implemented.

Rationale

A two-way stop requires a driver to cross traffic streams from either direction; this poses a potential risk, because cross traffic may be proceeding rapidly and drivers may be less prepared to accommodate to errors made by crossing or turning drivers. Most critically, drivers proceeding straight through the intersection must be aware of the fact that the cross-street traffic does not stop, and that they must yield to cross-street vehicles from each direction before proceeding through the intersection.

Diminished Capability

Older drivers are disproportionately penalized by the late realization of this operating condition, due to the various sources of response slowing previously discussed.

Supporting Evidence

Studies of cross-traffic signing to address this problem have shown qualified but promising results in a number of jurisdictions (Gattis, 1996). Data from crash analyses in Arkansas, Oregon, and Florida

showed significant reductions in right-angle crashes after cross-traffic signing was installed at problem intersections.

Picha, Schuckel, Parham, and Mai (1996) conducted a survey of 2,129 drivers in five States (CA, MN, MS, PA, and TX) to evaluate driver understanding of right-of-way conditions and preference for supplemental signs at two-way, stop-controlled intersections. The majority of the respondents (59 percent) were between ages 25 and 54, however, 22 percent were age 65 or older. The sign most often preferred (by 84 percent of the sample) was the CROSS TRAFFIC DOES NOT STOP word message with a horizontal double-headed arrow symbol.

Recommendation #16

Section 4E.10 Pedestrian Intervals and Signal Phases

Existing MUTCD Section 4E.10 text (Keep existing MUTCD text and add proposed CA Supp text):

Guidance:

> Where pedestrians who walk slower than 1.2 m (4 ft) per second, or pedestrians who use wheelchairs, routinely use the crosswalk, a walking speed of less than 1.2 m (4 ft) per second should be considered in determining the pedestrian clearance time.

Proposed CA Supplement Section 4E.10 text (Add proposed text in addition to the above MUTCD text):

Guidance:

> Where older pedestrians routinely use the crosswalk, a walking speed of 0.85 m (2.8 ft) per second should be considered in determining the pedestrian clearance time.

Background:

To accommodate the shorter stride and slower gait of less capable (15th percentile) older pedestrians, and their exaggerated "start-up" time before leaving the curb, pedestrian control-signal timing based on an assumed walking speed of 0.85 m/s (2.8 ft/s) is recommended.

Rationale

A nationwide review of fatalities during the year 1985, and injuries during the period of 1983–1985, showed that 39 percent of all pedestrian fatalities and 9 percent of all pedestrian injuries involved persons age 64 and older. While the number of injuries is close to the population distribution (approximately 12 percent), the number of fatalities far exceeds the proportion of older pedestrians. The percentages of pedestrian fatalities and injuries occurring at intersections were 33 percent and 51 percent, respectively. (Hauer, 1988)

Diminished Capability

Age-related diminished capabilities, which may make it more difficult for older pedestrians to negotiate intersections, include decreased contrast sensitivity and visual acuity, reduced peripheral vision and "useful field of view," decreased ability to judge safe gaps, slowed walking speed, and physical limitations resulting from arthritis and other health problems.

Older pedestrian problem behaviors include a greater likelihood to delay before crossing, to spend more time at the curb, to take longer to cross the road, and to make more head movements before and during crossing (Wilson and Grayson, 1980).

Supporting Evidence

Older pedestrian walking speed has been studied by numerous researchers. Hoxie and Rubenstein (1994) measured the crossing times of older and younger pedestrians at a 21.85-m (71.69-ft) wide intersection in Los Angeles, CA, and found that older pedestrians (age 65 and older) took significantly longer than younger pedestrians to cross the street. In this study, the average walking speed of the older and younger pedestrians was 0.86 m/s (2.8 ft/s) and 1.27 m/s (4.2 ft/s), respectively.

Another effort was conducted at two crosswalk locations at two intersections in Sydney, Australia (a major 6-lane divided street, and a side street), where the design crossing speed was changed from 1.2 m/s to 0.9 m/s (4.0 ft/s to 3.0 ft/s) (Job, Haynes, Quach, Lee, and Prabhaker, 1994). Observations were made during 3,242 crossings during a baseline period (1.2 m/s [4.0 ft/s] design crossing speed) and 2 and 6 weeks after the flashing DON'T WALK interval was extended to allow for the slower crossing speed under study. The authors note that the assumed walking speed of 1.2 m/s (4.0 ft/s) leaves almost 15 percent of the total population walking below the assumed speed. Extending the clearance interval resulted in a decrease in the percentage of pedestrian-vehicle conflicts, from 4 percent in the baseline period to 1 percent in the experimental period at 2 weeks and also 1 percent at 6 weeks, at the wider intersection. At the conclusion of this research, the authors recommended a reduction in the design walking speed from 1.2 m/s to 0.9 m/s (4.0 ft/s to 3.0 ft/s) at locations where there is significant usage by older pedestrians.

Relationship to Other Guides

Section 4E.10 of the MUTCD suggests the use of 1.2 m (4 ft) per second as the normal walking speed for establishing the pedestrian clearance interval. However, it is noted that slower speeds may be used where routine users include slower pedestrians or pedestrians in wheelchairs.

It is also noted as an option that passive pedestrian detection equipment may be used to extend the clearance interval for slower pedestrians. More information on the technology available for this application can be found at www.walkinginfo.org/pedsmart.

04-14 Proposed CA Supplement text (Target Compliance Dates)

The following proposal was discussed during the August 11, 2004 CTCDC Workshop and full Committee's recommendation is needed to include it in the California Supplement.

Proposed CA Supplement text (To be added to Introduction part of the CA Supplement):

Target Compliance Dates
(For non-compliant TCDs on existing highways)

Standard:
Unless allowed per the Option below, in cases involving new highway or bikeway construction or reconstruction, the traffic control devices installed (temporary or permanent) shall be in conformance with the MUTCD 2003 and the California Supplement to the MUTCD 2003 before that highway is opened or re-opened to the public for unrestricted travel pursuant to the California Vehicle Code 21401.

Option:
In cases involving new highway or bikeway construction or reconstruction, the traffic control devices installed (temporary or permanent) may be in accordance with pre May 20, 2004 traffic control device standards per Caltrans Traffic Manual, if in the judgement of the engineer, incorporating the MUTCD 2003 and the California Supplement standards would impose a significant delay or a significant increase in costs for the project.

Support:
Reconstruction, as used in the Standard and Option topics above, for the purpose of a traffic control device would mean if a particular device is modified in any form or shape or is relocated. If a reconstruction project does not modify or relocate a traffic control device, although encouraged, there would be no obligation to upgrade the traffic control device per MUTCD 2003 and the California Supplement standards.

Standard:
Unless allowed per the option below, non-compliant traffic control devices on existing highways and bikeways shall be brought into compliance with the MUTCD 2003 and the California Supplement as part of the systematic upgrading of substandard traffic control devices (and installation of new required traffic control devices) required pursuant to the California Vehicle Code 21401.

Option:
All traffic control devices on existing highways and bikeways that have become non-compliant per MUTCD 2003 and the California Supplement adopted standards may remain in service through the end of their useful service life, unless identified specifically with a target compliance date per the list that follows.
To limit financial impact on agencies and for fiscal responsibility reasons, existing inventory of non-compliant traffic control devices may continue to be used until these inventories are depleted.

Standard:
The target compliance dates listed in the Introduction part of the MUTCD are deleted and shall not apply in California.

The following traffic control devices on existing highways that are non-compliant per the MUTCD 2003 and the California Supplement have been singled out for specific target compliance dates by the California Traffic Control Devices Committee and California Department of Transportation. The target compliance dates for these devices shall be as follows:

CA Code	Title/Description	Comment	Target Date
R16B	NO RIGHT TURN word message sign	Use MUTCD R3-1 No Right Turn symbol sign	**January 1, 2010**
R17B	NO LEFT TURN word message sign	Use MUTCD R3-2 No Left Turn symbol sign	**January 1, 2010**
R19	NO LEFT OR U TURN word message sign	Use MUTCD R3-18 No Left or U Turn symbol sign	**January 1, 2010**
R34A	No U TURN word message sign	Use MUTCD R3-4 No U Turn symbol sign	**January 1, 2010**
SR2-M	SPEED LIMIT 35 mph 56 km/h sign	1976 Metric sign never implemented	**January 1, 2007**
SR3-M	END 35 mph 56 km/h SPEED LIMIT sign	1976 Metric sign never implemented	**January 1, 2007**
SR24-1	STOP ON RED SIGNAL word message sign	Use MUTCD R10-6 STOP HERE ON RED with arrow sign	**January 1, 2010**
SR31	SCHOOL STOP CROSSING round shape Paddle	Use CA Code C28A octagon shape Paddle	**January 1, 2010**
SR36	CLOSED Red on White octagon shape sign	Use MUTCD R11-2 ROAD CLOSED sign	**January 1, 2010**
W54	Pedestrian Crossing Symbol with crosswalk lines	Use MUTCD W11-2 Pedestrian Crossing symbol without crosswalk lines & W16-7P diagonal downward pointing arrow plaque	**January 1, 2011**
W66	School Crossing Symbol with crosswalk lines	Use MUTCD S1-1 School Crossing symbol without crosswalk lines & W16-7P diagonal downward pointing arrow plaque	**January 1, 2011**
W66A	SCHOOL XING word message sign	Use MUTCD S1-1 School Crossing symbol without crosswalk lines & W16-7P diagonal downward pointing arrow plaque	**January 1, 2011**
SW1-1	TRAFFIC FROM RIGHT(LEFT) DOES NOT STOP with arrow sign	Use MUTCD W4-4P CROSS TRAFFIC DOES NOT STOP plaque without the arrow	**January 1, 2007**
SW6-M	40 mph - 64 km/h sign	1976 Metric sign never implemented	**January 1, 2007**
SW18-2.1	VERTICAL CLEARANCE ___FT. ___IN.	Use MUTCD W12-2 Low Clearance sign or W12-2P rectangular plaque	**January 1, 2010**

SW25	School Symbol - SCHOOL XING with crosswalk lines	Use MUTCD S1-1 School Crossing symbol without crosswalk lines & W16-7P diagonal downward pointing arrow plaque	**January 1, 2011**
SW27	Skewed RR Crossing symbol with Motorcycle symbol sign	Use MUTCD W10-12 Skewed Crossing symbol sign	**January 1, 2015**
SW27-1	Skewed RR Crossing symbol with Motorcycle & Bike symbol sign	Use MUTCD W10-12 Skewed Crossing symbol sign	**January 1, 2015**
SW28	STEEL DECK with Motorcycle symbol sign	Use modified CA Code SW28 STEEL BRIDGE DECK word message sign	**January 1, 2015**
SW72-M	EXIT 30 mph 48 km/h sign	1976 Metric sign never implemented	**January 1, 2007**

Request For Experimentation

04-9 Request to Experiment with "Watch The Road" sign P 1 of 6

CITY OF LOS ANGELES
CALIFORNIA

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JAMES K. HAHN
MAYOR

October 7, 2004

Mr. Hamid Bahadori, P.E.
Principal Transportation Engineer
Automobile Club of Southern California
3333 Fairview Road
Costa Mesa, CA 92626

REQUEST TO EXPERIMENT WITH "WATCH THE ROAD" ROADWAY SIGNS IN THE CITY OF LOS ANGELES

Dear Mr. Bahadori:

The City of Los Angeles Department of Transportation (LADOT) is requesting authority from the California Traffic Control Devices Committee (CTCDC) to experiment with "Watch the Road" roadway signs as part of Los Angeles County's Watch the Road education and awareness campaign. The request will test the effectiveness of safety slogan signs as part of a larger traffic safety campaign. The City requests that the Automobile Club of Southern California sponsor our request to experiment.

BACKGROUND

Over the past five years, Los Angeles County roadways claimed more than 3,550 lives, injured another 440,000 and impacted thousands of families. These deaths and injuries were the result of traffic accidents and for the most part were caused by driving too fast for conditions, aggressive driving and inattentive driving. The aftermath of these crashes is heartrending, the cost to society is high, and the crashes contribute to millions of hours of unexpected traffic congestion.

"Watch the Road" is an education and awareness campaign designed to reduce the bad behaviors of roadway users in Los Angeles County that contribute to traffic crashes. The campaign targets drivers, pedestrians and bicyclists; its goals are to save lives, reduce injuries and relieve traffic congestion. Operation Traffix is a coalition of public, private and non-profit organizations that founded the Watch the Road Campaign. The coalition is committed to increasing traffic safety and mobility in the Los Angeles region. Founding members include: the Automobile Club of Southern California (ACSC), the California Department of Transportation (Caltrans), the California Highway Patrol (CHP), the City of Los Angeles Department of Transportation

(LADOT), the County of Los Angeles Department of Public Works (LACDPW), the Greater Los Angeles New Car Dealers Association, the Los Angeles County Metropolitan Transportation Authority (MTA) and the Southern California Association of Governments (SCAG).

The desired results of the Watch the Road education and awareness campaign are to: reduce fatal and injury crash rates; modify behavior of target audiences (motorists, bicyclists and pedestrians); increase awareness for responsible driving, bicycling and walking; and reduce traffic congestion. The Top Ten Roadway User Bad Behaviors identified by Operation Traffix are: driving too fast for conditions, aggressive driving, inattentive driving, driving under the influence, driving through red lights, not yielding to pedestrians, bicycling on the left side of road, bicycling through red lights, walking without looking, and walking outside crosswalks.

The Watch the Road campaign began in May 2004 and will run until at least December 2005. Campaign messages will be placed via television Public Service Announcements (PSAs); radio PSAs and traffic reports; billboards; newspaper and magazine advertisements; roadway signage; exterior and interior bus ads; bus shelter and bus bench ads; vehicle bumper stickers; the display of campaign materials at community events and safety fairs; and the distribution of campaign brochures and message cards to community groups, schools, associations, and other interested stakeholders. Some examples of Watch the Road messages are "Slow down, your family is waiting for you" and "It's better to lose one minute of your life than your life in one minute."

While television PSAs are not set to air until November 2004, progress is already being made with the placement and distribution of campaign messages. For example, CHP officers reporting on morning traffic conditions on three local television stations have recently begun to close their broadcasts with Watch the Road messages, while radio PSAs and traffic reports are currently airing on local stations during morning and afternoon/evening commute hours. The CHP has also started placing Watch the Road bumper stickers on its (Los Angeles) fleet vehicles, as has Caltrans (District 7), the Los Angeles County Sheriff's Department, the Los Angeles Police Department (LAPD), various City of Los Angeles departments and (participating) City-franchised taxicab companies. Similarly, the two largest transit operators in Los Angeles County, MTA and LADOT, have started placing exterior and interior ads on their bus fleets; other transit operators are also participating. In addition, LADOT has placed Watch the Road messages on its Changeable Traffic Message Signs throughout the City and at exits of selected City-owned parking facilities.

SCOPE

The City of Los Angeles Department of Transportation (LADOT) is requesting approval from the California Traffic Control Devices Committee (CTCDC) to experiment with a non-standard traffic device on its roadways. Specifically, LADOT, as a member of Operation Traffix, requests authority to experiment with Watch the Road roadway signs as a part of Los Angeles County's Watch the Road education and awareness campaign. The Department proposes to place up to 100 Watch the Road signs throughout the City at select Major and Secondary Highway entrances to the City and at prominent community boundaries or "gateways"; the signs will contain the message "Watch the Road."

The objective of the Watch the Road roadway signs is to make motorists, bicyclists and pedestrians entering the City of Los Angeles and various communities aware of the Watch the Road campaign and, upon repeat exposure to the signs, make them associate the Watch the Road "brand" with campaign messages that they will be exposed to through television PSAs, billboard advertisements, bus ads etc. Watch the Road signs will familiarize roadway users with the campaign, help them recognize its various messages, and make them receptive to the campaign's goals. Watch the Road roadway signs placed at select City and community boundary entrances will raise awareness of the Watch the Road campaign, reinforce the campaign's messages, and make the campaign brand synonymous with good road-user behavior.

The proposed Watch the Road roadway signs will be similar to California Guide Sign No. S33 for Safety Corridors. While the Safety Corridor signs are installed at each end of conventional State Highways, Watch the Road guide signs will be installed only on City streets at select City boundary entrances of Major and Secondary Highways and at prominent community gateways, as previously indicated. The proposed Watch the Road sign specifications are similar to those of the S33 (CA Code) sign: 1) size no larger than 2.5m (8 ft.) wide and 1.25m (4 ft.) high; and 2)

text having a primary safety message. The size of the Watch the Road signs will be in proportion to the 6" text used (capital letters). At this time, the Watch the Road sign's format/design has not been determined, but the sign is likely to have a black background, white "Watch the Road" and "Operation Traffix" text, and a double yellow vertical stripe on the left-hand side of the sign, all of which is consistent with the official Watch the Road logo. However, LADOT may opt to use a sign format similar to the S33 (CA Code) sign (white background and black text) to provide limited flexibility for sign design so that other Los Angeles County jurisdictions can possibly use similar Watch the Road signs to allow local variation (such as the use of different city seals) while still conforming to the overall Watch the Road campaign message.

WORK PLAN

As discussed above, the proposed Watch the Road roadway signs will be just one element of the Watch the Road campaign, the various messages of which will be distributed via television PSAs, billboard advertisements, bus ads etc. Again, as mentioned previously, the objective of the Watch the Road signs will be to make motorists, cyclists and pedestrians aware of the Watch the Road campaign and to make the campaign brand synonymous with good road-user behavior. Given this, LADOT believes that it will be very difficult, if not impossible, to gauge the effectiveness of the Watch the Road roadway signs (in and of themselves) by measuring changes in driver behavior and accident statistics because the signs will only be part of the overall campaign. LADOT, therefore, proposes that the work plan to measure the effectiveness of the experiment be the evaluation study for the Watch the Road campaign itself i.e. measuring the success (or lack thereof) of the Watch the Road roadway sign experiment will be accomplished by measuring the success of the entire Watch the Road campaign.

Realistically, not all of the 10 million residents of Los Angeles County will respond positively to the Watch the Road education and awareness campaign, but there are many individuals who will

process the messages of the campaign and, over time, modify their behavior–just a 10% reduction in crashes equates to saving approximately 70 lives and avoiding 8,800 injuries each year in Los Angeles County. LADOT, as a member of Operation Traffix, is taking the lead role in measuring the effectiveness of the Watch the Road campaign. Although this may appear to be a daunting exercise, LADOT is confident that meaningful data can be collected and analyzed to determine if the campaign is meeting its goals of reducing crash rates, modifying roadway user behavior, and reducing traffic congestion.

LADOT's evaluation of the effectiveness of the Watch the Road campaign will be accomplished through a combination of data collection/analysis and field measurement. For example, accident statistics and roadway user behavior data will be collected and analyzed to determine if crash rates and bad behaviors are reduced during the campaign and whether they can be attributed to the campaign. Likewise, surveys and field tests (bicycle and pedestrian) will be conducted during the course of the Watch the Road campaign to determine whether road-user behavior is (positively) modified and awareness for responsible driving, bicycling and walking is increased. Before the campaign was launched on May 18, 2004, LADOT collected preliminary accident and roadway user behavior data and conducted field experiments to gauge baseline or "before" conditions; results from August 2004 are now being analyzed. In April 2005 and February 2006, LADOT will again collect accident and roadway user behavior data using surveys and field experiments to measure changes in conditions after Watch the Road messages have been distributed via PSAs, advertisements, signage etc. Results will be available in July 2005 and May 2006 respectively, with a final evaluation in September 2006, as summarized below:

DATA	DATA COLLECTION	RESULTS AVAILABLE
Before Condition	5/2004	8/2004
Mid-campaign Condition	4/2005	7/2005
After Condition	2/2006	5/2006
Final Evaluation		9/2006

TIME PERIOD

The time period for the proposed experimentation with Watch the Road signs will follow the schedule of the Watch the Road campaign from the (presumed) approval of this request to experiment until the estimated completion of the education and awareness program in May 2006, a period of approximately 18 months.

Please contact Michael May of my staff at (213) 482-6970 if you have any questions or concerns with our request to experiment with Watch the Road signs.

Respectfully submitted,

Wayne K. Tanda
General Manager

MTM:mtm
CTCDC WTRver3

ATTACHMENTS

cc: Devinder Singh, CTCDC

04-10 Slow for the Cone Zone Sign P 1of 4

PROPOSAL

The California Department of Transportation is requesting authority from the California Traffic Control Devices Committee (CTCDC) to experiment with "Slow for the Cone Zone" construction signs as part of the statewide "Slow for the Cone Zone" education and public awareness campaign. The experiment will test the effectiveness of safety slogan signs in construction areas as part of a larger traffic safety media campaign.

BACKGROUND

In the past six years, nearly 35,000 highway work zone collisions have occurred within California. Of this number, 293 people were killed and more than 17,000 were injured. Additionally, the Department has reported 161 highway employee fatalities since 1924. Highway workers say that for every collision, there are numerous close calls, underscoring the magnitude of the problem. The overwhelming consensus among highway workers and law enforcement officials is that motorists simply do not slow down and drive with caution in highway work zones.

And, without educating and reaching out to the California citizens statewide, the problem is expected to get worse. The number of vehicle miles traveled (VMT) on the California highway system has increased by 16% in the last seven years and is projected to increase another 18% in the next three years.

An additional factor is the number of teen drivers on the roadways. Approximately 17,000 teen drivers receive new driver's licenses each month in California. It is important to educate these inexperienced drivers about the dangers inherent to themselves and highway workers in work zones.

The additional traffic congestion will create a need for more night work in light of Caltrans' commitment to minimize the amount of delay to motorists due to construction and maintenance activities. Reduced visibility at night and the increased number of motorist driving while fatigued or impaired by alcohol or drugs will create additional hazards for motorists and workers in construction zones.

Meanwhile, with responsibility for more than 50,000 lane-miles of California highway, Caltrans is faced with building and maintaining one of the largest transportation systems in the world.

Finally, there are increasing incidents of road rage reported by Caltrans and CHP field personnel. More and more, highway workers are observing aggressive and reckless driving by motorists incensed by traffic congestion, whether it is caused by roadwork, a collision or typical rush-hour delays.

The collision of these factors is inevitable; more cars, dangerous roadwork, more congestion, and shorter tempers. The number of collisions in work zones can be expected to show significant

increases unless motorists across California are educated and their driving behaviors are modified.

As shown in the chart below, the three years prior to implementation of the pilot "Slow for the Cone Zone" campaign reflected significantly higher in numbers of collisions, injuries and fatalities than the three years during the campaign. The positive impact of that campaign is well documented in public surveys.

YEARS	TOTAL COLLISIONS	FATAL COLLISIONS	INJURY COLLISIONS	NUMBER OF FATALITIES	NUMBER OF INJURIES
1997 –1999 (3 YEARS PRIOR TO SLOW FOR CONE ZONE CAMPAIGN)	19,092	128	5,962	159	9,915
2000-2002 (3 YEARS DURING SLOW FOR CONE ZONE CAMPAIGN)	15,367	117	4,610	134	7,587
MEASURED IMPROVEMENT	**3,725**	**11**	**1,352**	**25**	**2,328**

Over the next two years, Caltrans will be expanding that campaign statewide, which will include radio spots, television commercials, billboards, bus ads, etc.

As part of that campaign, the Department proposes to experiment with road signs in construction zones to remind motorists at the most critical time, while they are entering a construction zone, to "Slow for the Cone Zone." The signs will be used in combination with speed feedback signs so that motorists are aware of the speed limit, as well as their actual speed.

The Department will be working with UC Berkeley researchers to conduct before and after studies to measure the effectiveness of the road signs used in construction zones.

Special

ENGLISH UNITS

A	B	C	D	E	F	G	H	J	K
114	78	1.25	9	8.5	19.5	32.5	38	4	14.5

METRIC UNITS

A	B	C	D	E	F	G	H	J	K
2896	1981	32	229	216	495	826	965	102	368

5-Color Legend Sign
Black, Blue, Orange,
Pantone Process Blue C (CT Logo),
Pantone Process Cyan C (CT Logo)

48.000" across sides 6.000" Radius, 1.250" Border, White on Blue;
"SLOW" D; "FOR THE" D; "CONE" E; "ZONE" D;

04-11 Bicycle May Use Full Lane

City of Santa Cruz
Experimentation Request
"Bikes May Use Full Lane" Sign

Problem.

Section 21202 (a) of the California Vehicle Code allows a bicyclist to leave the right-hand edge of the roadway when reasonably necessary to avoid conditions that make it unsafe to continue to do so. A substandard width lane is listed as one of these conditions. "Share The Road" and "Roadway Narrows" are signs traditionally used in this context. However, neither of these signs explicitly advises the bicyclist or the motorist what their proper behavior should be in this circumstance. This creates an environment of unpredictability on the part of both roadway users and could contribute to collisions.

Proposed Sign.

Roadway users need more information about how to handle this situation. A substandard width lane (conventionally considered to be 14' or less) does not allow enough room for a motorist to pass a bicyclist within the lane. If the bicyclist moves left toward the center of the lane it is an indication to the motorist that the bicyclist needs more room to travel safely. The motorist then must wait until conditions allow to move into the adjacent lane or to pass the bicyclist.

The proposed sign, "Bikes May Use Full Lane", gives clear direction to bicyclists as well as motorists for the bicyclist to move to the left toward the center of the lane. This message also tells the motorist that they must yield space to the bicyclist. The accompanying graphic illustrates these roadway positions, thus eliminating the ambiguity of the message "share the road".

Illustration.

See attached photograph and locations map.

Supporting Data.

The sign is currently in place in two locations in Santa Cruz. At the first location (East Cliff Drive), the sign was installed three years following a fatal collision in September 2000 involving a motorist passing a bicyclist at the location. The bicyclist was riding downhill on the right-hand side of the 2-lane, 24' roadway at 8 % grade. There is a ½-mile gap in the bike lanes at this location. The "Bikes May Use Full Lane" sign replaced a "Share The Road" sign that was in place at this location at the time of the fatal collision. The second location (High Street) is also a downhill grade with a ½-mile gap in bike lane striping where bicyclists traveling in the center of the lane are more visible and more predictable to motorists.

The intent of the sign is to provide increased predictability and visibility of bicyclists to motorists to increase their safety in the roadway. Anecdotal evidence shows more bicyclists riding further to the left at the locations where the signs have been installed. None of the locations have experienced any bicycle collisions subsequent to sign installation. The sign provides clearer information to bicyclists and motorists regarding the proper and permitted position of bicyclists in the roadway under these special circumstances.

Experimentation Request.

The City of Santa Cruz would like to continue to study these sign installations for the next 6 months, at which time the Santa Cruz Public Works Department will submit to Caltrans an evaluation report. The evaluation report will include collision histories before and after installation, number of users, and 2-hour observation studies of the road positioning of bicyclists and motorists. Communication regarding this request should be made with Cheryl Schmitt, Bicycle/Pedestrian Coordinator in the Public Works Department. She can be reached at 831-420-5187 or email cschmitt@ci.santa-cruz.ca.us.

21202. (a) Any person operating a bicycle upon a roadway at a speed less than the normal speed of traffic moving in the same direction at that time shall ride as close as practicable to the right-hand curb or edge of the roadway except under any of the following situations:

(1) When overtaking and passing another bicycle or vehicle proceeding in the same direction.

(2) When preparing for a left turn at an intersection or into a private road or driveway.

(3) When reasonably necessary to avoid conditions (including, but not limited to, fixed or moving objects, vehicles, bicycles, pedestrians, animals, surface hazards, or substandard width lanes) that make it unsafe to continue along the right-hand curb or edge, subject to the provisions of Section 21656. For purposes of this section, a "substandard width lane" is a lane that is too narrow for a bicycle and a vehicle to travel safely side by side within the lane.

(4) When approaching a place where a right turn is authorized.
(b) Any person operating a bicycle upon a roadway of a highway, which highway carries traffic in one direction only and has two or more marked traffic lanes, may ride as near the left-hand curb or edge of that roadway as practicable.

04-11 Request to Experiment with "Flashing Yellow Arrows" P 1 of 10

ENGINEERING DEPARTMENT
303 West Commonwealth Avenue, Fullerton, California 92832-1775
Telephone • (714) 738-68
Facsimile • (714) 738-31
Website: www.ci.fullerton.ca.

October 21, 2004

Hamid Bahadori, P. E., T. E.
Principal Transportation Engineer
Automobile Club of Southern California
333 Fairview Road, Suite A131
Costa Mesa, California 92626

RE: Flashing Yellow Arrow – Request for Experimentation

Dear Mr. Bahadori:

The City of Fullerton, within Orange County, California, is requesting the California Traffic Control Devices Committee (CTCDC) approval to implement Protected Permissive Left Turn (PPLT) phasing using the experimental Flashing Yellow Arrow (FYA) at six signal approaches located at three different intersections. All locations presently utilize protected only left turn phasing. The three locations are distributed throughout the City and experience a variety of driver types, such as commuters, shoppers, students, and potential new drivers near a Department of Motor Vehicles site.

The City employs a Contract Traffic Engineer, Mr. Mark Miller of Albert Grover & Associates (AGA). Mr. Miller lives in the City and has been the City's Traffic Engineer since 1997. AGA has been a pioneer with PPLT in Southern California and has designed many of the existing PPLT installations within the City. AGA will be responsible for the FYA design and daily operation.

The City has applied for and received approval from the FHWA to implement the FYA. Attached is a copy of FHWA's approval letter.

The City appreciates your immediate consideration of our request and looks forward to helping to establish the usage of the very promising FYA approach to PPLT operation in California.

Mr. Hamid Bahadori
October 21, 2004
Page 2

Please call Mr. Miller at (714) 738-6330 on Mondays and Wednesdays if you have any questions regarding our request. You can also call Mr. Miller or Mr. Grover at the AGA office number, (714) 992-2990.

Respectfully Submitted,

Don Hoppe
Director of Engineering
City of Fullerton

Projects\Fullerton\149-063\Request Experiment Hoppe to Bahadori Ltr.doc

DEPARTMENT OF TRANSPORTATION

October 26, 2004

Hamid Bahadori, P. E., T. E.
Principal Transportation Engineer
Automobile Club of Southern California
333 Fairview Road, Suite A131
Costa Mesa, California 92626

RE: Flashing Yellow Arrow – Request for Experimentation

Dear Mr. Bahadori:

The City of Pasadena is requesting the California Traffic Control Devices Committee (CTCDC) approval to implement Protected Permissive Left Turn (PPLT) phasing using the experimental Flashing Yellow Arrow (FYA) at a maximum of three intersections. The potential intersections include:

1) Arroyo Parkway/Glenarm Street – two approaches: east/west
2) Arroyo Parkway/California Boulevard - four approaches
3) Arroyo Parkway/Delmar Boulevard - four approaches

The east/west approaches of the Arroyo Parkway/Glenarm Street intersection operate under a "split phase" signal phasing. All other identified approaches currently utilize standard protected/permissive left turn phasing. All approaches include a separate left turn lane for the left turning traffic.

Intersection #1 is currently controlled by Caltrans, and should permission from CTCDC be granted, the City will request formal approval from Caltrans to modify the operation of the traffic signal accordingly.

We understand that the City of Fullerton, California has applied for and already received approval from the FHWA to implement the Flashing Yellow Arrow operation at three intersections, and that the City is also requesting permission from the CTCDC to test this operation at their identified intersections. The details of the FYA operation is contained in the technical report submitted to the CTCDC by the City of Fullerton, therefore, this letter only identifies the unique features of the operation intended for Pasadena intersections.

221 East Walnut Street, Room 210 • Pasadena, CA 91101
(626) 744-6470

Mr. Hamid Bahadori
Flashing Yellow Arrow – Request for Experimentation
October 26, 2004, Page 2

The three intersections identified in this letter are adjacent to the new Light Rail transit that has been in operation in Pasadena since July 2003. All intersections are equipped with necessary railroad preemption signal timing features as required.

In the case of Arroyo Parkway/Glenarm intersection (east/west under split phasing), a recent study by Albert Grover & Associates concluded that the operation of the intersection and hence the total delay and queue of cars could be improved by converting the east/west approaches to a Protected/Permissive operation.

The other two intersections (Arroyo Parkway/Delmar and Arroyo Parkway/California) currently operate under a PPLT phasing; however, their operation could be improved as discussed below.

Under a PPLT phasing for approaches leading to the railroad tracks, the traffic signal is subject to the railroad preemption features which could lead to a "left turn trap". This is caused when the signal is operating in the east/west direction crossing the RR tracks. Once the signal goes to track clearance phase, the signal is forced to terminate one thru green (going to YELLOW) while keeping the opposing approach GREEN. In order to overcome this "left turn trap", the signal is programmed to revert to the north/south movements for at least 10-15 seconds before returning to the track clearance phase. This causes additional delay to all approaches, and especially to the east/west movements leading to the RR tracks. This operation also requires additional train arrival warning time which further complicates the signal timing operations.

The FYA operation simplifies the signal timing and eliminates the "left turn trap" situation by being able to "lag" a phase during the track clearance phase.

We appreciate the CTCDC's consideration of our request and look forward to receiving the committee's permission to experiment with this operation, thereby reducing considerable delay at our congested Pasadena intersections.

Please feel free to call me if you have any questions regarding our request.

Respectfully,

Bahman Janka, P.E.
Transportation Administrator
(626) 744-4610
bjanka@ci.pasadena.ca.us

cc: Joyce Y. Amerson, Director of Transportation
Norman Baculinao, Traffic Engineering Manager

Request to the California Traffic Control Devices Committee (CTCDC) for Experimentation by Implementation of the Flashing Yellow Arrow Display

By

Mark Miller, P. E.
City Traffic Engineer
City of Fullerton
Engineering Department
303 West Commonwealth Avenue
Fullerton, California 92832-1775
Phone: 714-738-6330
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October 15, 2004

Request to Experiment by Implementation of the Flashing Yellow Arrow Display

Preface

The research project, NCHRP 3-54, Evaluation of Traffic Signal Displays for Protected Permitted Left Turn Control, conducted by Kittelson and Associates, Inc. (KAI) as the prime contractor, has completed the field implementation of the flashing yellow arrow display for the permissive indication at protected/permitted left turns. The flashing yellow arrow has shown good results for driver understanding and safety. The implementation of the flashing yellow arrow display should continue in order to collect additional field data even though the NCHRP 3-54 research project will not be conducting any analysis of this field data under the current contract. To that regard, City of Fullerton is submitting to CTCDC for approval for experimental use of this test display.

Statement of the problem

The NCHRP 3-54 project evaluated the safety and effectiveness of different signal displays and phasing for protected/permissive left-turn control (PPLT). Many agencies have sought alternatives to the green ball indication used in PPLT since the green ball can produce yellow trap situations if not used properly (i.e., lead/lag phasing schemes). NCHRP 3-54 has conducted several studies of both the green ball permissive display and several other displays. The flashing yellow arrow has been shown to be the most promising alternative display to the green ball display.

Description of the Proposed Change

The proposed change would allow the use of a flashing yellow arrow indication as the permissive interval associated with the protected/permissive left-turn control. The proposed flashing yellow display is recommended for experimental testing based upon the results of several studies conducted within the NCHRP 3-54 project. Research has demonstrated that driver understanding is lower with the green ball permitted display as compared to other permitted displays being used in various parts of the country. The flashing yellow arrow display is better understood than the green ball display and has few fail critical errors (drivers turning left without the right-of-way).

The flashing yellow arrow provides versatility in application. The flashing yellow arrow display enables all of the following turning movement modes of operation:

- Protected/permissive
- Protected only
- Permissive only
- Prohibited (No Left Turn)

The flashing yellow arrow can be used for left- or right-turn treatments, although it is recognized that the left-turn treatment will be the most predominant use.

The flashing yellow arrow display eliminates the left turn "trap." The protected phase can operate as a leading or lagging movement without regard for the type of operation and phase sequence in the other direction, and can change between leading and lagging sequences during the day. Side street phases can be skipped and a leading left turn safely re-introduced (sometimes called "backing up"). The protected turn phase can be vehicle actuated and skipped in the absence of demand, regardless of the phase sequence.

Proposed Flashing Yellow Arrow Display Arrangements

The research team, in partnership with project panel and technical advisory group members, has identified several display arrangements that demonstrate good motorist understanding. Different display arrangements are recommended for an exclusive left-turn display and shared display.

Exclusive Display Arrangements

There are at least four possible PPLT signal displays that are recommended for installation of the flashing yellow arrow display at a location where there is an exclusive left-turn lane and the left-turn display is a separate display (not used by the adjacent through movements). Those alternative displays are shown in Figure 1 below. The City of Fullerton requests CTCDC approval to test display number 1 shown in Figure 1.

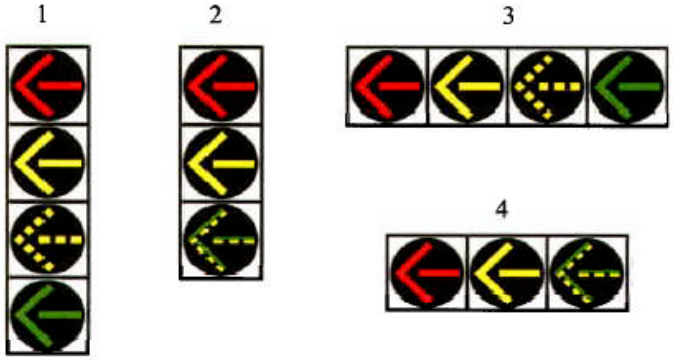


Figure 1. Exclusive FYA Display Arrangements

It is noted that the basic signal arrangement is a four-section arrangement. However, if bi-modal lens is employed (bottom or far right section), then a three-section arrangement can be used. The

three-section arrangement may be desired for clearance purposes or for ease of implementation if an existing three-section arrangement is available. The signal arrangement can be mounted either vertically or horizontally.

One, and only one, of the four arrows are illuminated at all times. The flashing yellow arrow is illuminated when traffic can safely turn by yielding to opposing through traffic and/or pedestrians (permissive operation). The other three arrows are used as in the normal three-color exclusive left turn display. The red arrow is displayed when it is unsafe to make a left turn movement. The green arrow is displayed when the left turn movement can be made with no conflicting simultaneous vehicle or pedestrian movement (protected operation). The steady yellow arrow is illuminated for a few seconds as a clearance indication following both the green arrow and the flashing yellow arrow.

Proposed Work Plan

The City of Fullerton will install the flashing yellow arrow display at six signal approaches. Each location is considered to be a typical intersection containing no unique geometric or operational features. The proposed PPLT intersections have a right angle relationship to all intersecting approaches. The approach for which the FYA will be installed has an exclusive left-turn lane. The horizontal grade is relatively flat. All lanes meet current design standards, as much as possible (12-foot travel lanes). The existing left-turn treatment (before implementation of the FYA) is protected only. The implementing agency has identified three intersections that will not receive any improvements during the study period and will be used as control site intersections. The three intersections are:

1. Orangethorpe Avenue @ Lemon Street (N-S)
2. Euclid Street @ Valencia Drive (N-S)
3. Chapman Avenue @ Commonwealth Avenue (E-W)

Anticipated Changeover Implementation Issues

Past experience with implementing flashing indications has identified various obstacles or issues that may be a factor in future implementations.

Issues with replacement head size / mounting
This implementation of the flashing yellow arrow will utilize a 12-inch lens for all vehicle displays. There will be no conflict of head sizes.

Potential need for additional cabling
Due to the flashing indication, additional cabling will be necessary in order for the flashing display to be controlled by its own circuit and to be displayed concurrently with the opposing green ball phase.

Controller logic issues
In a typical PPLT situation, it is possible for the green ball display and green arrow display to

illuminate simultaneously. However, by converting to the flashing yellow arrow display, the flashing yellow arrow and green arrow displays cannot illuminate simultaneously.

Further, in a shared-head arrangement there could be an issue related to an agency's requirement of a red clearance interval following the protected interval display (the green arrow followed by steady yellow arrow). In a shared-head arrangement, a leading green arrow could be illuminated concurrently with a green ball for parallel through traffic. With such a display, a red ball cannot be illuminated for clearing the protected left turn movements, as it would conflict with the green ball. The City of Fullerton does not use red clearance intervals for protected left turn phases.

In unusual situations, additional or different phases could serve as parent phases to drive the flashing yellow arrow overlap. The same overlap logic can also be used to drive right turn arrows where appropriate.

The City of Fullerton's existing Eagle EPAC controller software can provide this functionality.

Conflict monitor issues

Past applications of flashing indications have required the use of special external logic units to prevent the conflict monitor from detecting a signal malfunction. The City of Fullerton will upgrade existing conflict monitors to provide proper FYA operation with the Eagle EPAC controllers.

Evaluation Plan

The City of Fullerton will obtain the most recent three years of "Before" crash data. "After" crash data will be collected and sent to CTCDC for later follow up analysis.

City of Fullerton responsibilities are:

- Identifying intersections for installing the flashing yellow arrow display on at least one intersection approach.
- Install or retrofit the appropriate signal arrangements (head).
- Make the necessary modifications, if any, to the existing signal controller and controller conflict monitor.
- Provide intersection data sheets for each location, which includes geometrics, and traffic volumes for all movements, approach posted speed limit, and pertinent operational data.
- Provide three years of before crash data and three years after crash data. Three years of after data will be forwarded directly to CTCDC for further study at a later date. The Before data will be submitted upon project approval.
- Track and report change over costs and implementation issues.
- Submit overall qualitative statement on the flashing yellow arrow operation.

Site Restoration

The City of Fullerton agrees to restore the experiment site to a state complying with the provisions of the MUTCD and California Supplement 2004:

- within three months following the end of the time period of the experiment, or
- at any time that the participating agency determines that significant hazards are directly or indirectly attributable to the experimentation, or
- if requested to do so by the CTCDC.

If, as a result of experimentation, a request is made that the Manual be changed to include flashing yellow arrow permissive indications, then the experimental device may remain in place until an official rulemaking action has occurred.

Reporting

City of Fullerton will provide semi-annual progress reports until the experiment is completed. A copy of the final results will be sent to CTCDC, within three months following completion of experimentation.

Project Administration

City of Fullerton will be responsible for administering this experiment under the direction of Mark Miller, City Traffic Engineer, located at 303 West Commonwealth Avenue, Fullerton, California 92832-1775.

Discussion Items P 1of 1

04-E Timetable for Combining the Two Documents to a Single Document

The committee will discuss timing for combining of the MUTCD 2003 and California Supplement into a single document.

04-F Section 2C.46 MUTCD 2003 P 1of 4

Committee Member Jacob Babico would like to discussion with the CTCDC members about the implementation of Section 2C.46 on page 2C-24 of the MUTCD 2003 and page 2C-17 of the CA Supplement. The question is: what would be the distance to place the intersection warning sign W2-1 or W2-2 signs supplemented with Advisory Speed Plaque W13-1 when the corner sight distance is limited?

Table 2C-4 on page 2C-6 of the MUTCD 2003 is different that Table II-1 of MUTCD 1986 and Table 2C-4 of MUTCD 2000.

The difference in methodology and computation for Safe Stopping Sight Distance and Passing Sight Distance between AASHTO, Caltrans Highway Design Manual, and the MUTCD 2003/CA Supplement.

MUTCD 2003
Section 2C.46 Advisory Speed Plaque (W13-1)

Option:
The Advisory Speed (W13-1) plaque (see Figure 2C-5) may be used to supplement any warning sign to indicate the advisory speed for a condition.

Standard:
The Advisory Speed plaque shall be used where an engineering study indicates a need to advise road users of the advisory speed for a condition.
If used, the Advisory Speed plaque shall carry the message XX km/h (XX MPH). The speed shown shall be a multiple of 10 km/h or 5 mph.
Except in emergencies or when the condition is temporary, an Advisory Speed plaque shall not be installed until the advisory speed has been determined by an engineering study.

Guidance:
Because changes in conditions, such as roadway geometrics, surface characteristics, or sight distance, might affect the advisory speed, each location should be periodically evaluated and the Advisory Speed plaque changed if necessary.

Option:
The advisory speed may be the 85th-percentile speed of free-flowing traffic, the speed corresponding to a 16-degree ball bank indicator reading, or the speed otherwise determined by an engineering study because of unusual circumstances.

Support:
A 10-degree ball-bank indicator reading, formerly used in determining advisory speeds, is based on research from the 1930s. In modern vehicles, the 85th-percentile speed on curves approximates a 16-degree reading.
This is the speed at which most drivers' judgment recognizes incipient instability along a ramp or curve.

California Supplement P 2of 4

Section 2C.46 Advisory Speed Plaque (W13-1)

The following is added to this section:

Standard:

If used, the speed shown on the W13-1 plaque shall not be in excess of the posted or maximum speed limit. The advisory speed shall be determined in accordance with Section 2C.101.

The Advisory Speed Plaque shall not be used in conjunction with any sign other than a warning sign, nor shall it be used alone. When used, it shall be positioned below the warning sign.

Table 2C-4. Guidelines for Advance Placement of Warning Signs
(English Units)

Posted or 85th-Percentile Speed	Advance Placement Distance [1]						
	Condition A: High judgment required[2]	Condition B: Stop condition[3]	Condition C: Deceleration to the listed advisory speed (mph) for the condition[4]				
			10	20	30	40	50
20 mph	175 ft	N/A[5]	N/A[5]	—	—	—	—
25 mph	250 ft	N/A[5]	100 ft	N/A[5]	—	—	—
30 mph	325 ft	100 ft	150 ft	100 ft	—	—	—
35 mph	400 ft	150 ft	200 ft	175 ft	N/A[5]	—	—
40 mph	475 ft	225 ft	275 ft	250 ft	175 ft	—	—
45 mph	550 ft	300 ft	350 ft	300 ft	250 ft	N/A[5]	—
50 mph	625 ft	375 ft	425 ft	400 ft	325 ft	225 ft	—
55 mph	700 ft	450 ft	500 ft	475 ft	400 ft	300 ft	N/A[5]
60 mph	775 ft	550 ft	575 ft	550 ft	500 ft	400 ft	300 ft
65 mph	850 ft	650 ft	650 ft	625 ft	575 ft	500 ft	375 ft

Notes:

[1] The distances are adjusted for a sign legibility distance of 50 m (175 ft) which is the appropriate legibility distance for a 125 mm (5 in) Series D word legend. The distances may be adjusted by deducting another 30 m (100 ft) if symbol signs are used. Adjustments may be made for grades if appropriate.

[2] Typical conditions are locations where the road user must use extra time to adjust speed and change lanes in heavy traffic because of a complex driving situation. Typical signs are Merge, Right Lane Ends, etc. The distances are determined by providing the driver a PIEV time of 6.7 to 10.0 seconds plus 4.5 seconds for vehicle maneuvers minus the legibility distance of 50 m (175 ft) for the appropriate sign.

[3] Typical condition is the warning of a potential stop situation. Typical signs are Stop Ahead, Yield Ahead, or Signal Ahead. The distances are based on the 1990 AASHTO Policy for stopping sight distance (page 120) providing a PIEV time of 2.5 seconds, friction factor of 0.30 to 0.40, minus the sign legibility distance of 50 m (175 ft).

[4] Typical conditions are locations where the road user must decrease speed to maneuver through the warned condition. Typical signs are Turn, Curve, or Cross Road. The distance is determined by providing a 1.6 second PIEV time (1990 AASHTO, page 119), a vehicle deceleration rate of 3 m/second^2 (10 ft/second^2), minus the sign legibility distance of 50 m (175 ft).

[5] No suggested minimum distances are provided for these speeds, as placement location is dependent on site conditions and other signing to provide an adequate advance warning for the driver.

Table 2C-4. Guidelines for Advance Placement of Warning Signs
(English Units)

Posted or 85th-Percentile Speed	Advance Placement Distance [1]								
	Condition A: Speed reduction and lane changing in heavy traffic[2]	Condition B: Deceleration to the listed advisory speed (mph) for the condition[4]							
		0[3]	10	20	30	40	50	60	70
20 mph	225 ft	N/A[5]	N/A[5]	—	—	—	—	—	—
25 mph	325 ft	N/A[5]	N/A[5]	N/A[5]	—	—	—	—	—
30 mph	450 ft	N/A[5]	N/A[5]	N/A[5]	—	—	—	—	—
35 mph	550 ft	N/A[5]	N/A[5]	N/A[5]	N/A[5]	—	—	—	—
40 mph	650 ft	125 ft	N/A[5]	N/A[5]	N/A[5]	—	—	—	—
45 mph	750 ft	175 ft	125 ft	N/A[5]	N/A[5]	N/A[5]	—	—	—
50 mph	850 ft	250 ft	200 ft	150 ft	100 ft	N/A[5]	—	—	—
55 mph	950 ft	325 ft	275 ft	225 ft	175 ft	100 ft	N/A[5]	—	—
60 mph	1100 ft	400 ft	350 ft	300 ft	250 ft	175 ft	N/A[5]	—	—
65 mph	1200 ft	475 ft	425 ft	400 ft	350 ft	275 ft	175 ft	N/A[5]	—
70 mph	1250 ft	550 ft	525 ft	500 ft	425 ft	350 ft	250 ft	150 ft	—
75 mph	1350 ft	650 ft	625 ft	600 ft	525 ft	450 ft	350 ft	250 ft	100 ft

Notes:

[1] The distances are adjusted for a sign legibility distance of 175 ft for Condition A. The distances for Condition B have been adjusted for a sign legibility distance of 250 ft, which is appropriate for an alignment warning symbol sign.

[2] Typical conditions are locations where the road user must use extra time to adjust speed and change lanes in heavy traffic because of a complex driving situation. Typical signs are Merge and Right Lane Ends. The distances are determined by providing the driver a PIEV time of 14.0 to 14.5 seconds for vehicle maneuvers (2001 AASHTO Policy, Exhibit 3-3, Decision Sight Distance, Avoidance Maneuver E) minus the legibility distance of 175 ft for the appropriate sign.

[3] Typical condition is the warning of a potential stop situation. Typical signs are Stop Ahead, Yield Ahead, Signal Ahead, and Intersection Warning signs. The distances are based on the 2001 AASHTO Policy, Stopping Sight Distance, Exhibit 3-1, providing a PIEV time of 2.5 seconds, a deceleration rate of 11.2 ft/second^2, minus the sign legibility distance of 175 ft.

[4] Typical conditions are locations where the road user must decrease speed to maneuver through the warned condition. Typical signs are Turn, Curve, Reverse Turn, or Reverse Curve. The distance is determined by providing a 2.5 second PIEV time, a vehicle deceleration rate of 10 ft/second^2, minus the sign legibility distance of 250 ft.

[5] No suggested distances are provided for these speeds, as the placement location is dependent on site conditions and other signing to provide an adequate advance warning for the driver.

04-G Overhead Pedestrian/School Crosswalk Signing with Yellow Flashing Beacons

Here's the Background: There are several installation of Overhead Flashing Yellow Beacons (OFYB) at the painted crosswalks for Pedestrians and/or Schools. Every OFYB installation consists of a Pole, Mast arm, W66 sign, and a Flashing light on each side of the sign mounted on the mast arm.

The current policy requires Assembly B which consists of similar sign and the single downward arrowhead be installed at the nearest location to the crosswalk.

How can rectify the situation? The answer to that probably is to added installation of Assembly B to the nearest crosswalk.

Information item:

04-5 Roundabout Signs & Pavement Markings Guidance Proposal P 1of 4

Information Item- - Proposed Changes to July 1, 2004 Roundabout Proposal

2

Section 3B.24 Markings for Roundabout Intersections

The following is added to this section:

~~Guidance~~Option:

A solid or broken white line ~~should~~ may be used on the outer (right) side of the circular roadway, as follows: A 200 mm (8 in) wide solid line across the splitter island, See Figure 3A-112, Detail 38A, and a ~~300~~200 mm (~~12~~ 8 in) broken white line consisting of 0.9 m (3 ft) segments with 0.9 m (3 ft) gaps across the lane(s) entering the roundabout. See Figure 3A-106, Detail 27D.

4a

Edit the last option paragraph to read as follows:

~~Option~~Guidance:

A yield line at roundabouts placed on an arc at the edge of the circular roadway should replace the dotted right edge line across the lane(s) entering the roundabout to delineate (see Section 3B.16) ~~may be used to indicate~~ the point behind which vehicles are required to yield at the entrance to a roundabout intersection per Figure 3B-14(CA).

Option:

For added emphasis, a dotted right edge line of the circular intersection and a transverse yield line to the flow of traffic approaching the circular intersection per Figure 3B-14 (CA) may be used in combination.

4b

The following is added to this section:

Option:

For roundabout intersections with two-lane approaches, channelizing lines and lane drops for roundabouts may be considered on a case-by-case basis. Solid, white channelizing lines and broken Lane Drop Line for Roundabouts may be considered as shown in Figure 3B-28 (CA). For details on the 200 mm (8 in) wide lines, see Figure 3A-111, Detail 37D and Figure 3A-112, Detail 38A.

See conceptual pavement markings figures A & B on following page

(Final proposal will update all figures to incorporate these changes)

Figure A. Recommended marking for Yield Line/Right Edge Line at Roundabout P 2 of 4

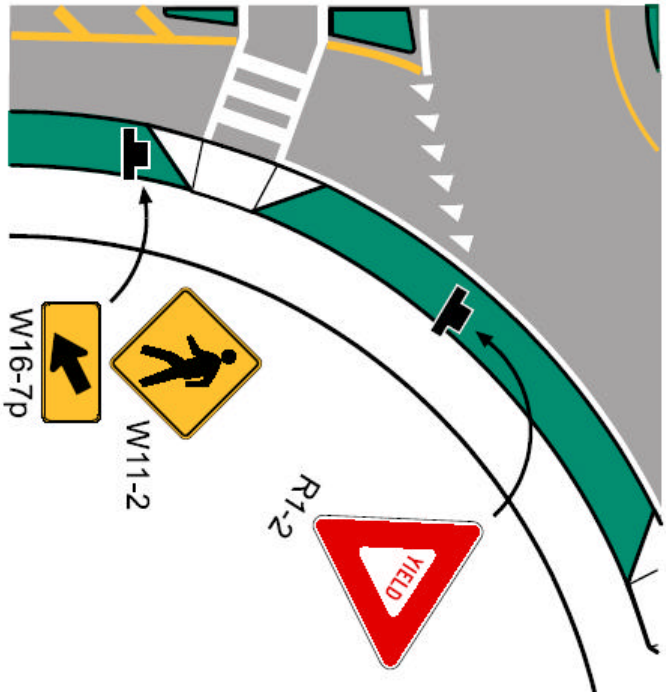
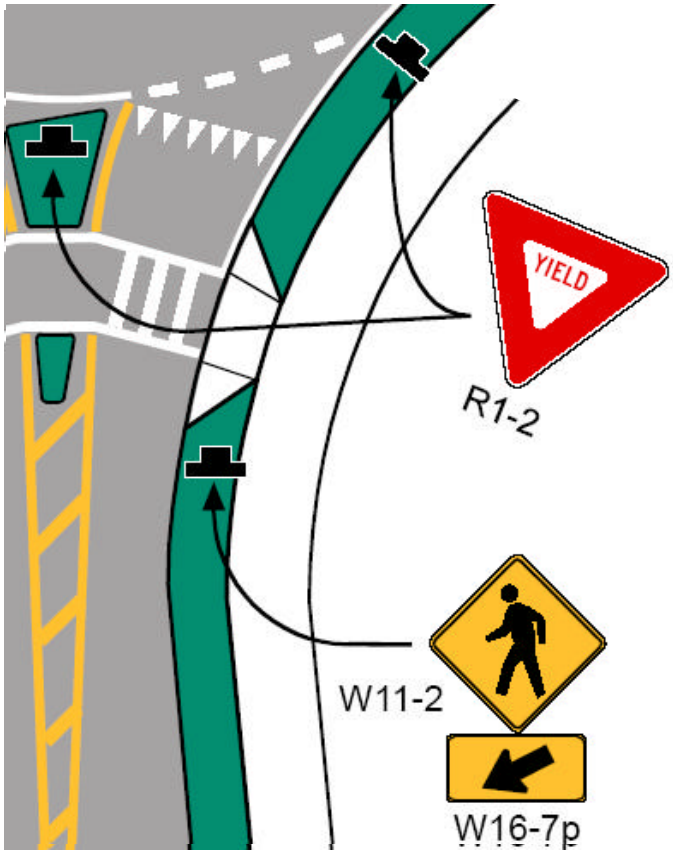
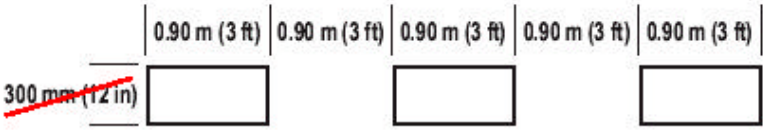


Figure B. Optional markings for Right Edge Line with transverse Yield Line at Roundabout



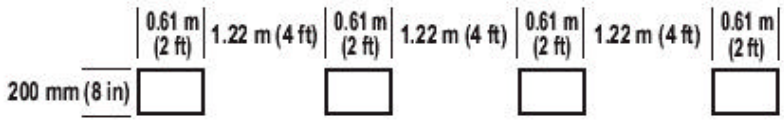
DETAIL 27D
Right Edge Line Extensions
For Roundabouts

recommend change to 200 mm (8 inch width)



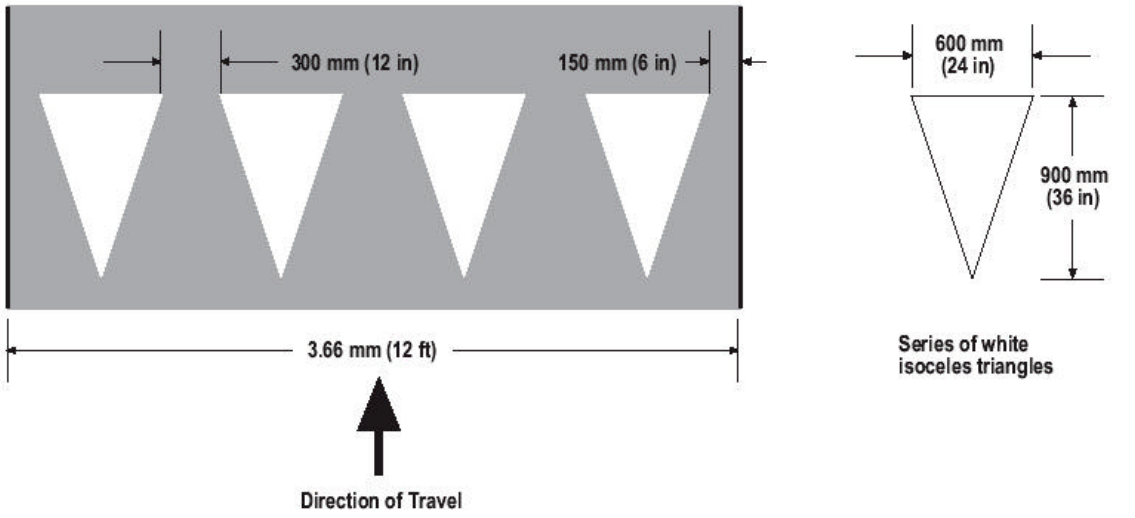
Right Edge Line Extensions For Roundabouts pattern for use to delineate the right edgeline of the circular roadway across the lane(s) entering the roundabout.

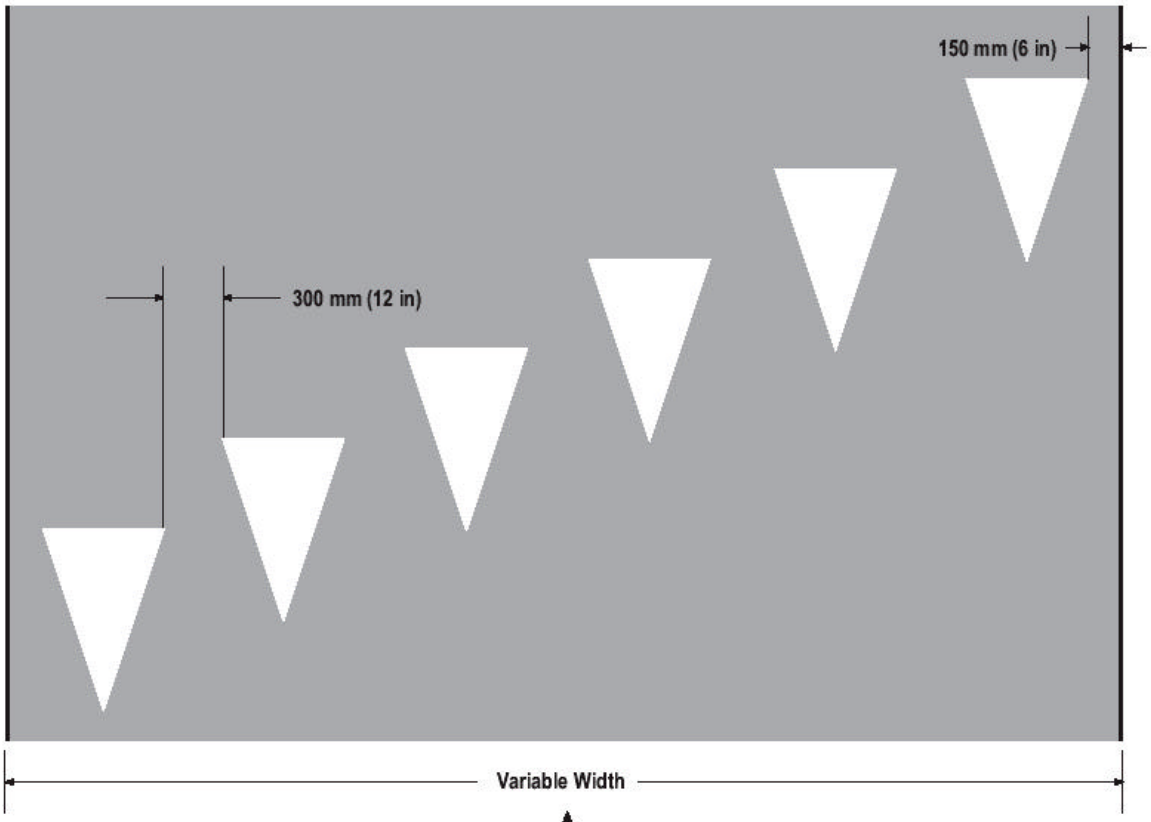
DETAIL 37D
Lane Drop Line
For Two-Lane Roundabouts



Lane Drop Line For Two-Lane Roundabouts pattern for use on mandatory exiting lanes from a two-lane roundabout.

Figure 3B-14 (CA). Examples of Yield Line Layouts





NOTE: If used, Yield Lines for Roundabouts shall be ~~staggered~~ per the curvature of the circular roadway. ~~The setback from the right edge line extension for roundabouts is 1.22 m (4 ft).~~ See Figures 3B-27 (CA) and 3B-28 (CA).